Configuring AppleTalk Services

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Bay Networks

Bay Networks

4401 Great America Parkway
Santa Clara, CA 95054

8 Federal Street
Billerica, MA 01821

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About This Guide

If you are responsible for configuring AppleTalk, you need to read this guide.

If you want to	Go to
Learn about the AppleTalk protocol	Chapter 1
Learn about special aspects of the Bay Networks implementation of AppleTalk	Chapter 2
Start AppleTalk on a router and get it running with default settings for parameters	Chapter 3
Change default settings for AppleTalk parameters	Chapter 4
View a list of the AppleTalk default settings	Appendix A

Before You Begin

Before using this guide, you must complete the following procedures. For a new router:

- Install the router (refer to the installation manual that came with your router).
- Connect the router to the network and create a pilot configuration file (refer to *Quick-Starting Routers*, *Connecting AN and ANH Systems to a Network*, or *Connecting ASN Routers to a Network)*.

Make sure that you are running the latest version of Bay Networks Site Manager and router software. For instructions, refer to *Upgrading Routers from Version 7–11.xx to Version 12.00*.

Conventions

angle brackets (< >)	Indicate that you choose the text to enter based on the description inside the brackets. Do not type the brackets when entering the command. Example: if command syntax is <*start_network_number*>.<*start_node_number*> you enter **25.36**
brackets ([ ])	Indicate optional elements. You can choose none, one, or all of the options.
ellipsis points	Horizontal (. . .) and vertical (⋮) ellipsis points indicate omitted information.
italic text	Indicates variable values in command syntax descriptions, new terms, file and directory names, and book titles.
quotation marks (“ ”)	Indicate the title of a chapter or section within a book.
separator (>)	Separates menu and option names in instructions. Example: Protocols > AppleTalk identifies the AppleTalk option in the Protocols menu.

Acronyms

AARP	AppleTalk Address Resolution Protocol
AEP	AppleTalk Echo Protocol
AMT	address mapping table
ATCP	AppleTalk Control Protocol
AURP	AppleTalk Update Routing Protocol
DDP	Datagram Delivery Protocol
DI	domain identifier
DLCI	data link connection identifier
ELAP	EtherTalk Link Access Protocol
FDDI	Fiber Distributed Data Interface
IP	Internet Protocol

LAN	local area network
NBP	Name Binding Protocol
PPP	Point-to-Point Protocol
RTMP	Routing Table Maintenance Protocol
SMDS	Switched Multimegabit Data Services
SNAP	Subnetwork Access Protocol
SNMP	Simple Network Management Protocol
TLAP	TokenTalk Link Access Protocol
UDP	User Datagram Protocol
WAN	wide area network
ZIP	Zone Information Protocol

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Santa Clara, CA	800-2LANWAN	408-495-1188
Valbonne, France	33-4-92-96-69-68	33-4-92-96-69-98
Sydney, Australia	61-2-9927-8800	61-2-9927-8811
Tokyo, Japan	81-3-5402-0180	81-3-5402-0173

Chapter 1
AppleTalk Overview

Configuring AppleTalk services on your router involves

- AppleTalk network organization, addresses, and zones
- Seed routers and nonseed routers
- The Bay Networks implementation of AppleTalk routing protocols
- Initialization of Bay Networks AppleTalk interfaces
- The Bay Networks implementation of AppleTalk Update-based Routing Protocol (AURP)
- More information about AppleTalk

AppleTalk Networking

The AppleTalk network system, developed by Apple Computer Inc., lets you communicate and share resources (such as printers or file servers) with other Apple and non-Apple users.

AppleTalk's dynamic addressing scheme lets you plug into an AppleTalk network to gain immediate access without complicated configuration procedures.

An AppleTalk internet unites physically distinct networks composed of AppleTalk end nodes connected by routers. The end nodes send and receive messages; the routers (like the Bay Networks AppleTalk router) send and receive messages, and also route messages, in datagram format, throughout the AppleTalk network.

AppleTalk Addresses

There are two types of AppleTalk networks: *extended* and *nonextended*. An extended network theoretically supports up to 16 million nodes and has the following characteristics:

- The network is assigned a *range* of 16-bit network numbers.
- Each node within the network is dynamically assigned a 24-bit AppleTalk address (Figure 1-1) that consists of a 16-bit network number, chosen from within the range assigned, combined with an 8-bit node number. The values 0, $FF, and $FE are reserved for future use.

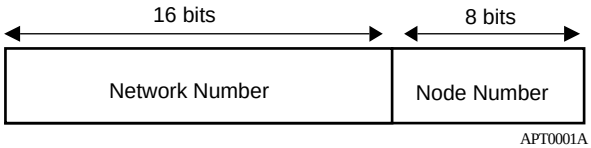


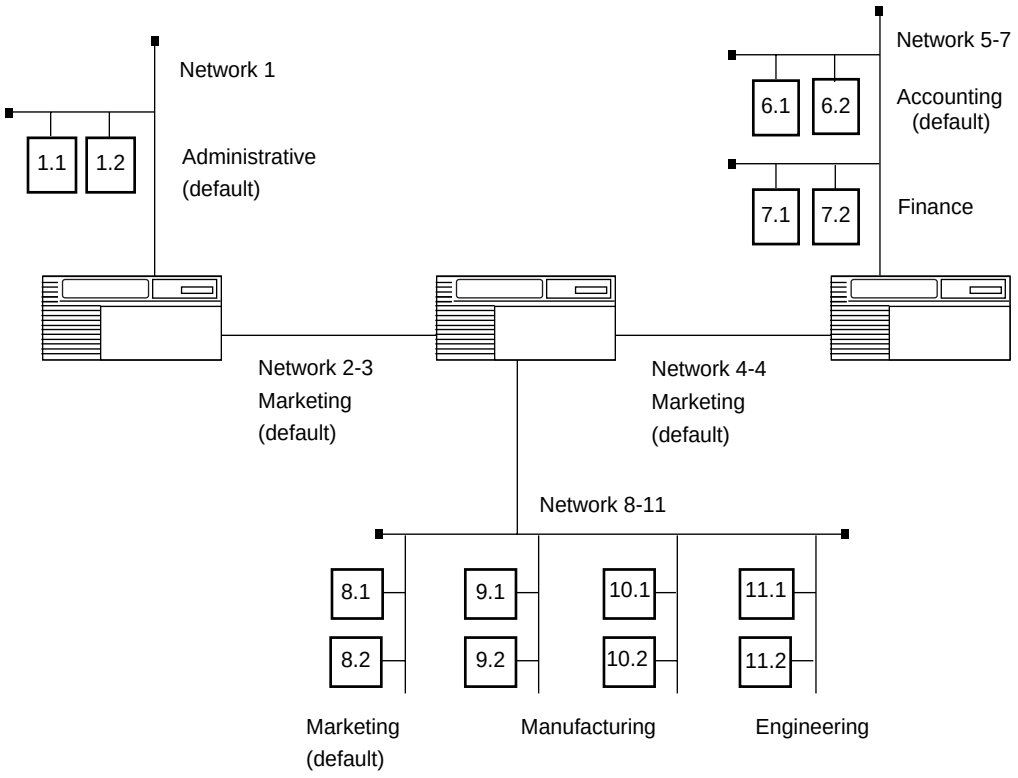
Figure 1-1. AppleTalk Address with 24 Bits

For example, in Figure 1-2, Networks 2-3, 4-4, 5-7, and 8-11 are extended networks.

A nonextended network supports up to 254 nodes and has the following characteristics:

- The entire network is assigned a *single* 16-bit network number.
- Each node within the network is dynamically assigned a 24-bit AppleTalk address that consists of the assigned network number combined with a unique, 8-bit node number.

For example, in Figure 1-2, Network 1 is a nonextended network.



Network NumberRange	Network Type	Default Zone	Zone List
1	Nonextended	Administrative	Adminstrative
2-3	Extended	Marketing	Marketing
4-4	Extended	Marketing	Marketing
5-7	Extended	Accounting	Finance Accounting
8-11	Extended	Marketing	Marketing Manufacturing Engineering

APT0002A

Figure 1-2. Extended and Nonextended AppleTalk Network

AppleTalk Zones

Each AppleTalk network is logically divided into *zones*. Zones help you identify the location of a network entity or service. Similar network services are usually assigned to the same zone.

A network's *zone list* contains all the zones assigned to the network. A nonextended network consists of only a single zone. You can divide an extended network into 255 zones, with one zone designated as the *default zone*. The same zone can be part of many different networks. When a new node first starts on the network, it is assigned to the default zone. Later, you can reassign it to any valid zone on the zone list.

Seed Routers and Nonseed Routers

Each AppleTalk network must have at least one designated *seed* router, which is a router configured with the following network information:

- Network number start range
- Network number end range
- Default zone name
- Zone list for the network

Seed routers share this network information with all other nonseed routers on the network. Multiple seed routers can reside on the same network, but their network ranges, default zone name, and zone list must be identical.

How the Bay Networks AppleTalk Router Works

This section describes the following AppleTalk protocols and notes any Bay Networks divergences from these standards:

- TokenTalk Link Access Protocol (TLAP)
- EtherTalk Link Access Protocol (ELAP)
- AppleTalk Address Resolution Protocol (AARP)
- Datagram Delivery Protocol (DDP)
- Routing Table Maintenance Protocol (RTMP)
- Zone Information Protocol (ZIP)
- Name Binding Protocol (NBP)
- AppleTalk Echo Protocol (AEP)
- AppleTalk Update-based Routing Protocol (AURP)

This section also describes how a Bay Networks AppleTalk interface initializes on the network.

AppleTalk Link Access Protocols (TLAP and ELAP)

The Bay Networks AppleTalk router uses AppleTalk Link Access protocols to transmit packets between nodes on the *same* physical network. (TokenTalk controls data transmission on Token Ring networks; EtherTalk controls data transmission on Ethernet networks.) The router also supports Fiber Distributed Data Interface (FDDI) and Bay Networks-proprietary synchronous encapsulation.

Note: The Bay Networks AppleTalk router does not support LocalTalk or AppleTalk Phase 1 routing and therefore cannot directly attach to nonextended networks.

AppleTalk Address Resolution Protocol (AARP)

For a Bay Networks AppleTalk router to forward a packet to a directly connected AppleTalk node, the router needs to know the

- Packet's AppleTalk address
- Corresponding hardware address of the node where the AppleTalk address resides

The router uses the AppleTalk Address Resolution Protocol (AARP) to map AppleTalk addresses to their equivalent hardware addresses. The router saves this information in its address mapping table (AMT), which lists all known AppleTalk addresses, corresponding hardware addresses, and the circuit/port where the address resolution is in effect.

The router updates and maintains its AMT by broadcasting and receiving AARP packets (Figure 1-3). When the router needs to send a packet to a given AppleTalk address, it scans its AMT to find the address. If the address is not found, the router broadcasts a single *Request* packet to find out which node is using the address.

If the address exists, the node whose address matches that specified in the Request packet sends back a *Response*, which identifies the hardware address that maps to the AppleTalk address. The router then updates its AMT with this new information. The router waits 2 seconds for a response.

AARP is also responsible for generating a unique AppleTalk address for each of the router's AppleTalk interfaces that have not been explicitly assigned. This process is called *probing*. The Bay Networks AppleTalk router implements this by first generating a tentative AppleTalk address for the interface in the format

<start_network_number>.<start_node_number>

where

- *<start_network_number>* is the lowest end of the network number range assigned to the network to which this interface connects.
- *<start_node_number>* is a randomly selected node number that could be assigned to this interface.

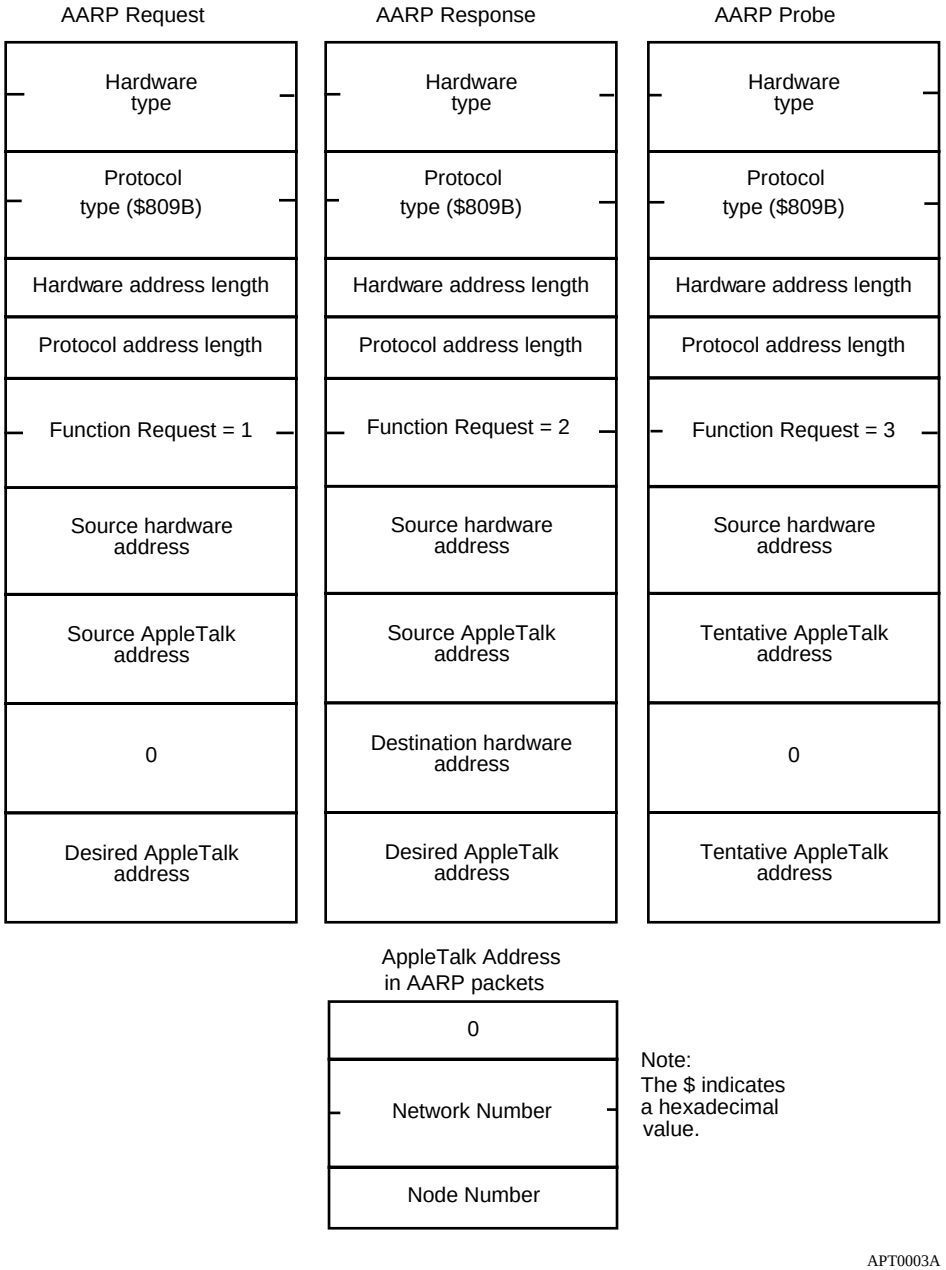


Figure 1-3. AARP Packets

Next, the router checks the validity of the address by broadcasting 10 AARP probe packets containing this address at 0.2-second intervals. (For WAN interfaces, the frequency is five AARP packets at 1.0-second intervals.) AARP probe packets inquire if any other node on the network is already using this address. If the router does not receive a response, then it knows that the address is unique on the network and assigns the address to the interface. If the router receives a response (or a probe for the same address), it knows the address is already in use. So the router increments the node number by 1, then sends out 10 more probes. It repeats this process until it does not receive a response, or runs out of all possible node numbers.

If the router runs out of possible node numbers, it increments the *start_network_number* by 1 and repeats the entire probe process. Finally, if the router is still unable to generate a unique address, it logs the error and shuts down the interface.

Note: If you statically configure the AppleTalk interface's address (setting the network ID and node ID to a nonzero value) and another AppleTalk device has already acquired this address, the router logs a message indicating that the address is already in use. The router cannot bring up such an interface.

Datagram Delivery Protocol (DDP)

The Bay Networks AppleTalk router uses the Datagram Delivery Protocol (DDP) to transmit packets between nodes on the network. The Datagram Delivery Protocol is an unreliable network layer protocol.

An AppleTalk datagram consists of the DDP header, immediately followed by the data. The Bay Networks router encapsulates all packets in an extended 13-byte DDP header (Figure 1-4). The source node sets the hop count field to zero before sending a packet out onto the network. Each router that receives the packet increments the hop count by one until it either reaches the destination end node, or reaches the maximum hop count (15), in which case it is discarded.

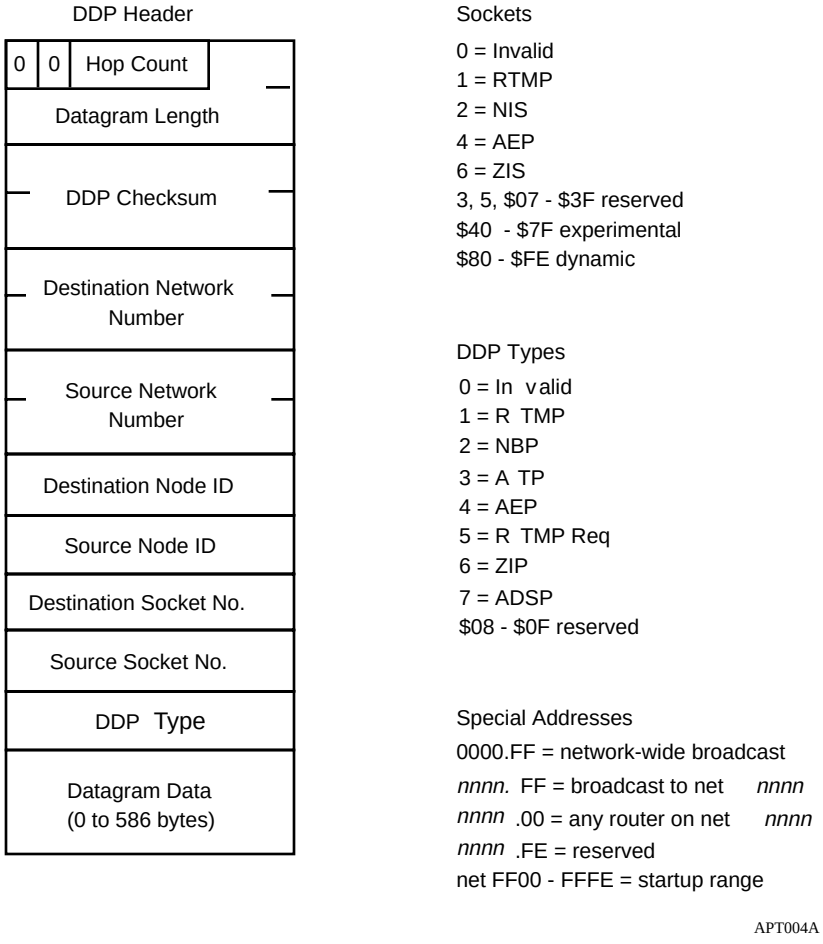


Figure 1-4. DDP Packet

When the Bay Networks AppleTalk router receives a packet, it checks to see if the packet's destination network number is the local network. If it is, the router passes it down to the data link layer that forwards the packet toward the destination node. If the destination network number is a different network, the router refers to its routing tables to determine the next hop on the shortest path to the destination.

Finally, the router increments the hop count by one, and forwards the packet toward the next hop. The router's routing tables are maintained using the Routing Table Maintenance Protocol.

Routing Table Maintenance Protocol (RTMP)

The Bay Networks AppleTalk router uses the Routing Table Maintenance Protocol (RTMP) to create and maintain the routing information DDP uses to transmit packets across an internet. Routing information is contained in the AppleTalk routing table.

Each table entry includes the following:

- Destination network range
- AppleTalk protocol address (network number and node number) through which the destination is reached
- Number of router hops to the destination
- Route status

Routers create and update their routing tables by periodically constructing and broadcasting RTMP data packets to all other routers on directly connected links. An RTMP data packet contains the source address and the information stored in the originating router's routing table. All routers receiving the data packet use this information to update their own routing tables (Figure 1-5).

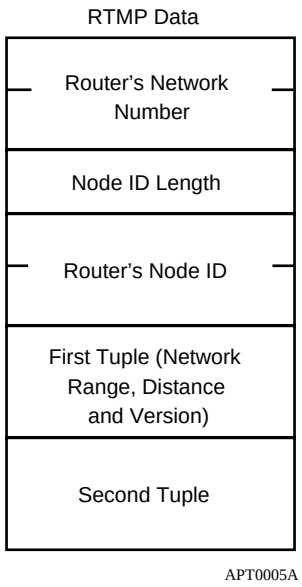


Figure 1-5. RTMP Data Packet

Zone Information Protocol (ZIP)

The Bay Networks AppleTalk router uses the Zone Information Protocol (ZIP) to map networks to zone names on the internet. The router stores this information in its zone information table, also called a *zone list*. The zone information table contains one entry for each network on the internet. The entry is in the format

<network_start, zone list>

The zone list field consists of a number of text strings that identify the zone names that are specified for that network. The router maintains and updates the zone list by broadcasting ZIP *Query* packets for zone list information to all other routers in the network. Other routers respond with ZIP response packets that have the zone lists (Figure 1-6).

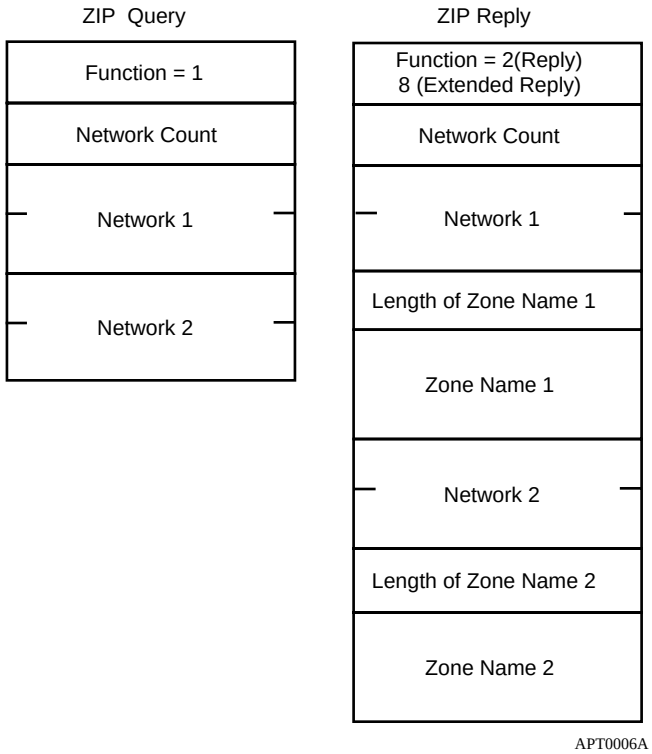


Figure 1-6. ZIP Response Packets

When an AppleTalk node starts on the network, it requests zone and network information from all routers on the circuit by broadcasting ZIP GetNetInfo request packets (Figure 1-7). Upon receiving a GetNetInfo request, the router replies with a GetNetInfo response packet that confirms or denies the validity of the zone name and supplies the correct network range. If the stored zone name is invalid, the node uses the default zone name that is configured for the network instead.

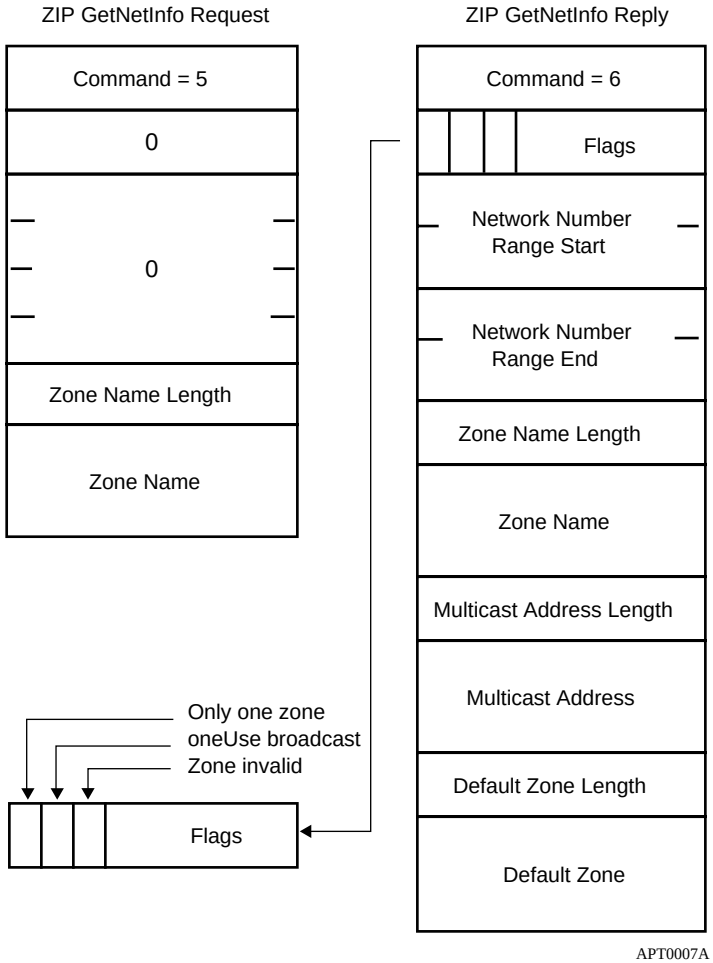


Figure 1-7. ZIP GetNetInfo Packets

Name Binding Protocol (NBP)

Macintosh users on an AppleTalk network refer to services by name, rather than by physical location. For example, if you want to locate a printer, select the Chooser and then pick the printer by name, rather than by its AppleTalk address.

The Bay Networks AppleTalk router uses the Name Binding Protocol (NBP) and the Zone Information Protocol to map names of services to AppleTalk addresses.

When the router receives an NBP Broadcast Request packet for a named entity from an AppleTalk node, it refers to its zone list to see in which network the requested entity's zone is located. If the zone is on the local network, it broadcasts an NBP Lookup Request packet. If the zone is located on a different network, it sends out an NBP Forward Request packet toward the router connected to the network with the destination zone. Upon receiving a forward request, that router then broadcasts an NBP Lookup Request (Figure 1-8).

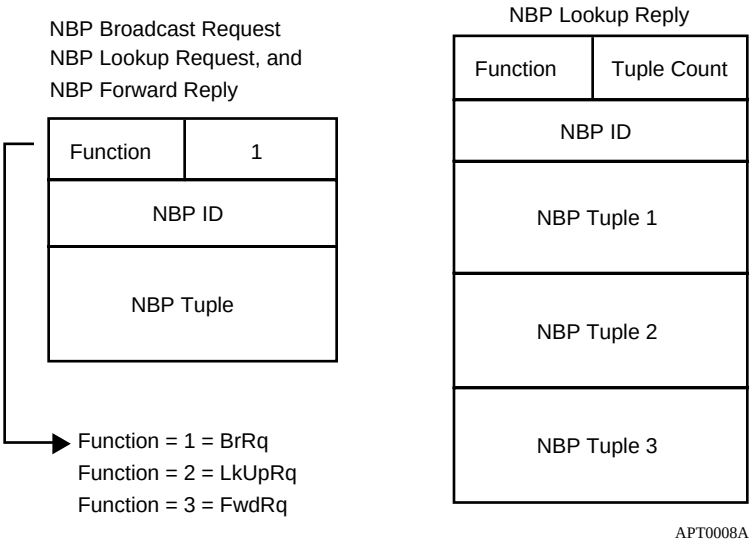


Figure 1-8. NBP Packets

An NBP named entity consists of the name, type, and zone name, where

- *Name* is the name assigned to the device that identifies it on the network.
- *Type* specifies the device type; for example, the type specified for a laser printer is identified by the type LaserWriter.
- *Zone name* specifies the AppleTalk zone in which the device resides.

AppleTalk Echo Protocol (AEP)

The Bay Networks AppleTalk router supports the AppleTalk Echo Protocol (AEP), which allows the router to respond to echo packets it receives from other nodes on the network.

AppleTalk Update-based Routing Protocol (AURP)

The Bay Networks AppleTalk router supports the AppleTalk Update-based Routing Protocol (AURP), which provides an optional set of features that you can use with an AppleTalk Phase 2 network. AURP provides more efficient use of network bandwidth, increased network security, and enables AppleTalk networks to exchange data through a *tunnel*.

Bay Networks supports three major AURP features:

- *AURP tunneling* to allow AppleTalk communications over existing wide-area Internet Protocol (IP) backbones
- *Update-based routing table maintenance* to reduce bandwidth use over a tunnel
- *Hop count reduction* to extend the current AppleTalk 15-hop limit

The following sections provide a brief overview of the AURP features that Bay Networks router software supports.

AURP Tunneling

AURP tunneling lets you connect two or more previously unconnected AppleTalk internets over an IP internet (Figure 1-9). The sending router encapsulates each AppleTalk data packet in IP and delivers it to the router on the other side of the tunnel. The router receiving the encapsulated packet removes the IP header and forwards the packet to the appropriate destination using standard AppleTalk delivery mechanisms.

AppleTalk routers that connect to an AURP tunnel are *exterior routers*. Exterior routers function as AppleTalk routers within the AppleTalk internet, and as end nodes within the IP internet. Exterior routers assign unique *domain identifiers* (DI) to AppleTalk internets to distinguish between multiple AppleTalk internets connected to the same tunnel.

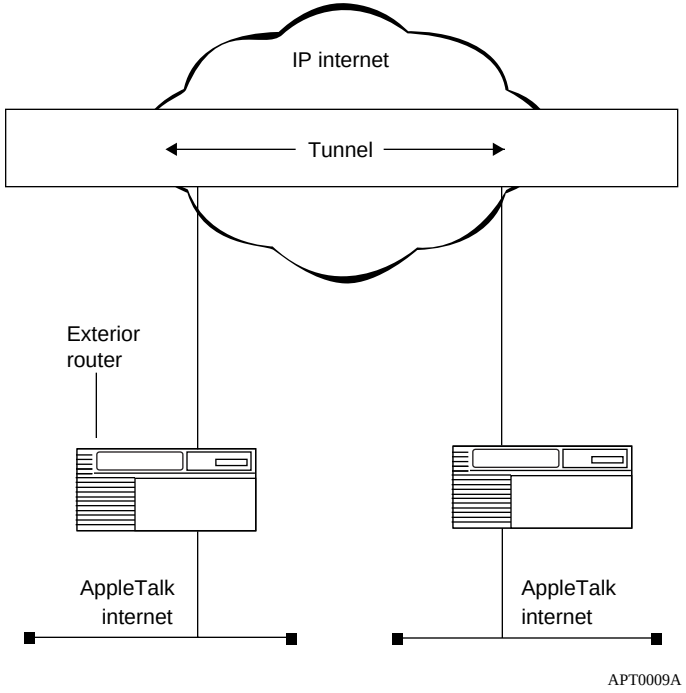


Figure 1-9. AURP Tunneling across an IP Internet

A Bay Networks AppleTalk router supports one fully connected or partially connected tunnel with multiple connections. In a fully connected tunnel, all exterior routers have connections to all other exterior routers in the tunnel and, as a result, have full access to all resources these routers provide (Figure 1-10).

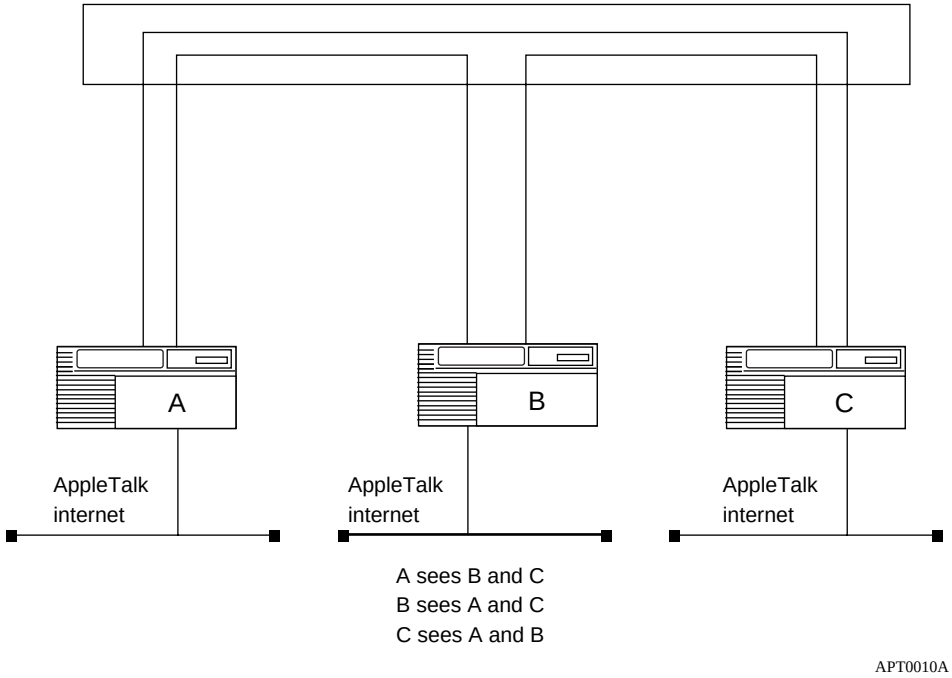


Figure 1-10. Fully Connected Tunnel

In a partially connected tunnel, two or more exterior routers do not have a connection. In such a tunnel, routers without an explicit connection cannot see each other's networks. This lets network administrators control the view and access that users have to the resources on various protected networks. An exterior router in a partially connected tunnel advertises only its local internet. It does not advertise network information learned through a different connection on the tunnel (Figure 1-11).

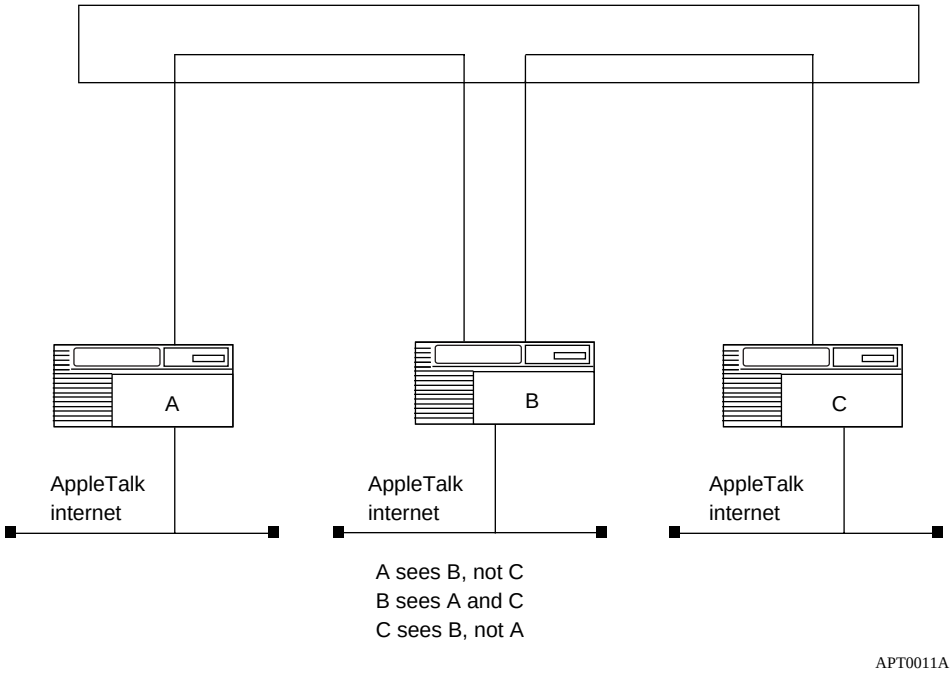


Figure 1-11. Partially Connected Tunnel

Tickle Request and *Tickle Acknowledgment* packets maintain the connection between two exterior routers. When an exterior router receives an AppleTalk data packet destined for an end system located across the IP internet, the router encapsulates the packet with the following headers before forwarding the packet onto the IP internet:

- *Data Link Header*, which specifies the data link frame information
- *IP Header*, which specifies the source and destination IP address
- *UDP Header*, which specifies the destination User Datagram Protocol (UDP) port
- *Domain Header*, which specifies the source and destination AppleTalk domain identifiers (DIs); for AURP tunneling, DIs are derived from IP addresses

A Domain Header consists of the following fields:

- *Destination DI*, which contains the DI of the exterior router to which a packet is forwarded
- *Source DI*, which contains the DI of the exterior router that is forwarding a packet
- *Version Number*, which contains the value 0001
- *Reserved*, which is reserved for future use and contains the value 0000
- *Packet Type*, which contains the value 0002 to identify the data that follows as AppleTalk data, distinguishing it from other data, such as routing data (value 0003)

The receiving exterior router decapsulates the datagram, then forwards it to the destination AppleTalk end system. Figure 1-12 shows the format of an AppleTalk data packet forwarded across an AURP tunnel.

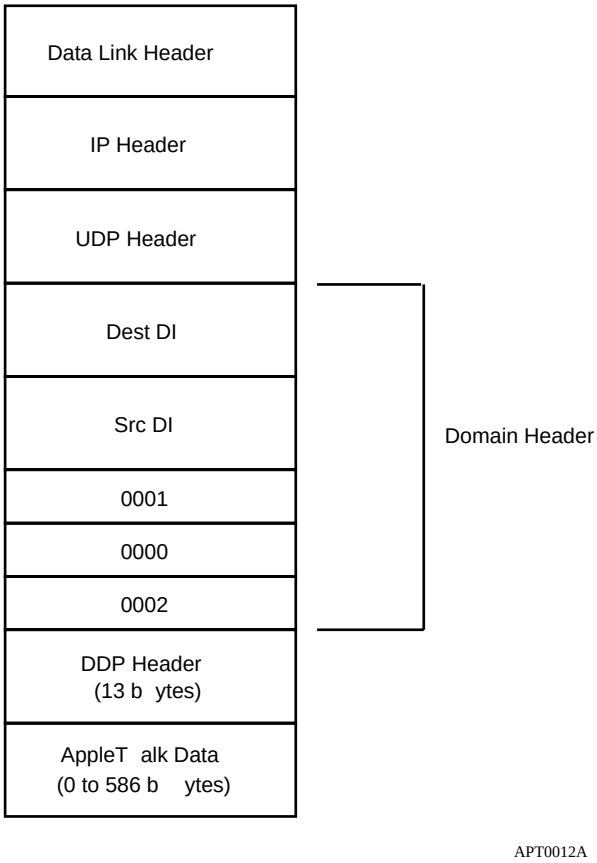


Figure 1-12. AppleTalk Data Packet Forwarded across an AURP Tunnel

Update-based Routing Table Maintenance

Exterior routers connected to a tunnel use AURP to exchange routing information with other exterior routers connected to the same tunnel.

Note: Within its local AppleTalk internet, an exterior router uses Routing Table Maintenance Protocol (RTMP) to maintain current routing information.

When two exterior routers establish a connection via an AURP tunnel, they exchange complete routing information. Once the initial routing exchange takes place, there are no more complete routing table exchanges.

Instead, an exterior router only generates routing updates when an event occurs that changes its routing information, thus reducing the amount of routing protocol traffic on the network. (Events that change routing information include network additions or deletions, metric changes, and next-hop changes.) In addition, the exterior router *buffers* updates until the next update interval occurs for the AURP connection.

Hop Count Reduction

When two AppleTalk networks communicate via a tunnel, the distance one of their packets must go to reach its destination can easily exceed the AppleTalk 15-hop limit. To ensure full access to resources beyond 15 hops, AURP provides a way to reduce the hop count within the DDP header of an AppleTalk packet. With Hop Count Reduction enabled, all nodes across the network appear reachable within the AppleTalk 15-hop limit.

Upon receiving an AppleTalk packet through a tunnel configured with Hop Count Reduction, AURP routers examine the routing table entry for that packet's destination network. If the destination network's distance plus the packet's hop count exceed 15 hops, the AURP router reduces the hop count value of the packet to ensure delivery of the packet.

For example, an AppleTalk router with AURP configured receives an IP-encapsulated packet with a DDP header hop count field containing a value of 7. Prior to sending the packet to its final destination, the router checks the appropriate distance metric in its RTMP table and determines that the packet must travel another 10 hops to reach its final destination. The AppleTalk router then resets the hop count field of the DDP header to a value of 5, allowing the packet to reach its destination within the AppleTalk router's local network.

When using Hop Count Reduction on a tunneling port, an exterior router must represent all networks in its local internet as being only one hop away. Hop count reduction allows the router to send and maintain routing information about networks beyond the 15-hop limit, thus ensuring full connectivity.

For More Information

The following documents provide technical detail on AppleTalk protocol implementation:

- Sidhu, G., R. Andrews, and A. Oppenheimer. *Inside AppleTalk.* 2d ed. Reading, Mass.: Addison-Wesley, 1990.
- Apple Computer. *AppleTalk Update-Based Routing Protocol.* Cupertino, Calif.: Apple Computer, 1993.
- Apple Computer. *The Design and Planning of Enterprise-Wide AppleTalk Internetworks*. San Francisco: AppleTalk Networking Forum, 1993.

Chapter 2
AppleTalk Implementation Notes

This chapter contains implementation notes for

- Configuring AppleTalk interfaces on WAN media
- Configuring seed router interfaces
- Specifying interface costs
- Enabling both AppleTalk routing and bridging on the same interface
- Specifying zone information for interfaces (add or remove zones; edit network and zone list information; configure zone filters)
- Configuring AppleTalk interfaces in a Token Ring network
- Configuring AppleTalk interfaces in a non-fully meshed Frame Relay topology
- Reducing excess routing traffic on a large AppleTalk network
- Adding AppleTalk routers to a transitional network
- Configuring AURP connections

Configuring AppleTalk Interfaces over WAN Media

The Bay Networks AppleTalk implementation includes Frame Relay, Switched Multimegabit Data Services (SMDS), and Point-to-Point Protocol (PPP) support that conforms to the following:

- RFC 1294: Multiprotocol Interconnect over Frame Relay.
- Oppenheimer, Alan. *SMDSTalk: AppleTalk over SMDS*. Apple Computer, August 17, 1992.
- RFC 1378: The PPP AppleTalk Control Protocol (ATCP).

AppleTalk Running on Frame Relay or SMDS

When you enable AppleTalk on a Frame Relay or SMDS circuit, you must specify a MAC address and a broadcast address for the circuit using the WAN MAC Address and WAN Broadcast Address parameters. See the section "Editing AppleTalk Interface Parameters" in Chapter 4 for instructions. If you do not specify these values, then

- For Frame Relay circuits, the router broadcasts to all DLCIs
- For SMDS circuits, the router uses the addresses specified at the SMDS circuit level

AppleTalk as a Nonextended Network over PPP

To make the Bay Networks AppleTalk software work with router software that uses nonextended network configurations over PPP (RFC 1378 compliant), you must configure the AppleTalk interface as a seed router for a nonextended network. (For more information about seed routers, see "Configuring Seed Router Interfaces" later in this chapter.)

Chapter 3 describes how to initially configure an AppleTalk interface on a PPP circuit. To edit an AppleTalk interface you have already configured, see "Editing AppleTalk Interface Parameters" in Chapter 4.

Make sure you configure the AppleTalk parameters as follows:

- Set the Network Start parameter to the desired value.
- Set the Network End parameter to 0, which indicates that the network is nonextended.
- Set the Default Zone parameter for the interface. The network can have only one zone, the Default Zone.
- Set the Network ID and the Node ID for the interface.

Figure 2-1 shows a sample AppleTalk Interface Configuration window for a nonextended configuration. Note that in the figure, the Network End equals 0.

Note: If two routers are running Bay Networks Version 7.70 router software or higher, and you want to configure an interface for AppleTalk over PPP on each router, both interfaces must be configured the same way for an extended or nonextended network.

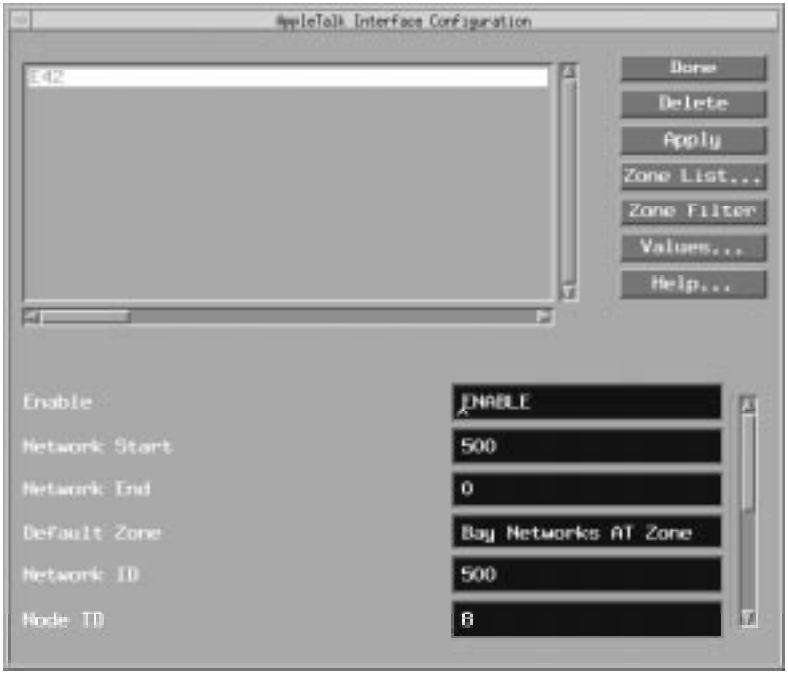


Figure 2-1. AppleTalk Nonextended Configuration over PPP

AppleTalk as an Extended Network over PPP

If you want to configure AppleTalk over PPP for an interface that is connected to a router running Bay Networks Version 5.70 or higher router software or Bay Networks Version 7.60 or higher router software, you must configure the AppleTalk interface as a seed router for an extended network. (For more information about seed routers, see "Configuring Seed Router Interfaces" later in this chapter.)

Chapter 3 describes how to initially configure an AppleTalk interface on a PPP circuit. To edit an AppleTalk interface you have already configured, see "Editing AppleTalk Interface Parameters" in Chapter 4.

Make sure you configure the AppleTalk parameters as follows:

- Set the Network Start and Network End parameters. The network must have a range of one (for example, 4-4 or 10-10).
- Set the Default Zone. The network can have only one zone, the Default Zone.
- Set the Network ID and Node ID for the interface.

Figure 2-2 shows a sample AppleTalk Interface Configuration window for an extended configuration. Note that in the figure, the Network Start and Network End are equal.

Note: If two routers are running Bay Networks Version 7.70 router software or later, and you want to configure an interface for AppleTalk over PPP on each router, both interfaces must be configured the same way for an extended or nonextended network.

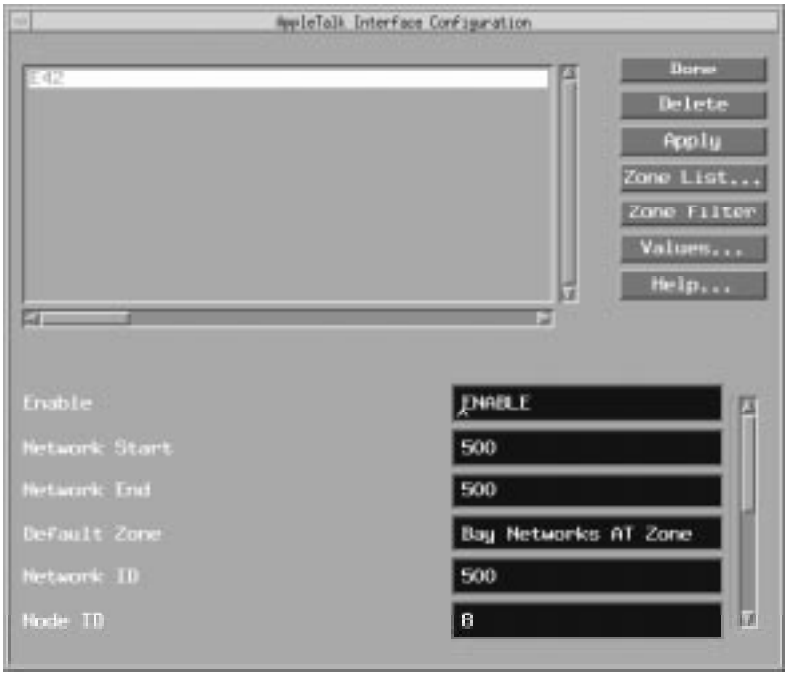


Figure 2-2. AppleTalk Extended Configuration over PPP

Configuring Seed Router Interfaces

If you specify a value for the Network Start parameter when enabling an AppleTalk interface, then the interface functions as a seed router. (If you do not set the Network Start parameter, then the interface is nonseed by default.)

In addition, a seed router interface requires you to

- Specify the Network End parameter.
- Specify the Default Zone parameter.
- Define a zone list.

If there are multiple seed routers on the network, all must be configured with the same values.

You *must* configure the interface as a seed router interface if it is the only AppleTalk router on the network. If a seed router already is configured on this network, you can configure this interface to be a nonseed router.

Chapter 3 describes how to initially configure a seed router interface. To edit an AppleTalk interface you have already configured, see "Editing AppleTalk Interface Parameters" in Chapter 4.

Specifying Interface Costs

You can assign a relative cost value to AppleTalk interfaces. When you specify a cost, the router adds it to the routes that the interface learns via RTMP data packets.

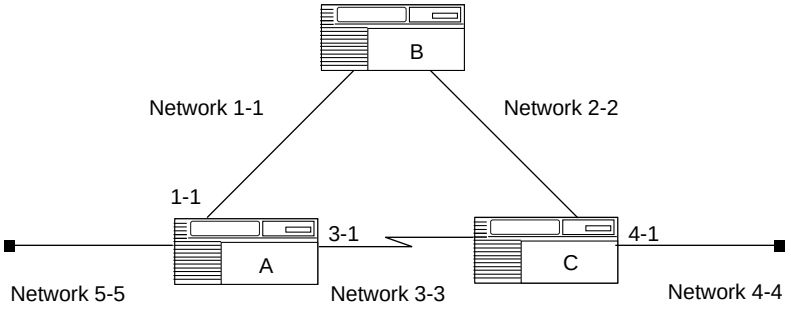
Since the AppleTalk router always chooses the least-cost (most direct) path to a destination, you can limit the use of an interface by assigning it a high cost. Figure 2-3 demonstrates how interface cost affects the router's decision-making process.

In Example 1, when no cost values are assigned to any of the AppleTalk interfaces, Router A always reaches Network 4-4 directly through Router C (because it advertises the least costly route).

As shown in Example 2, if an interface cost of 2 is assigned to Interface 3.1 (which increases the advertised hop count by 2), Router A now reaches Network 4-4 through Router B, because it advertises a lower cost route.

Note: The AppleTalk router does not route to networks that are more than 15 network hops away. Thus, when you assign an interface cost, make certain that the actual hop count, plus the interface cost you assign, does not exceed the 15-hop restriction.

For instructions on how to set the Cost parameter for an interface, see the section "Editing AppleTalk Interface Parameters" in Chapter 4.



Interface	Cost	Actual Hops to Network 4-4	Hop Count Learned by Interface
1.1	0	2	2
3.1	0	1	1

Example 1. Router A's preferred path to Network 4-4 = 3.1.

Interface	Cost	Actual Hops to Network 4-4	Hop Count Learned by Interface
1.1	0	2	2
3.1	2	1	3

Example 2. Router A's preferred path to Network 4-4 = 1.1.

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Figure 2-3. Assigning Circuit Costs to AppleTalk Interfaces

Enabling AppleTalk Routing and Bridging on the Same Interface

If you enable both AppleTalk routing and bridging on the same interface, configure a bridge filter on the interface to drop all AppleTalk Phase 2 AARP and DDP packets.

If you do not configure a filter, you may experience problems when you reboot the router. (This is because the bridge enables ahead of the AppleTalk router, causing packets to be bridged before AppleTalk routing starts.)

We suggest creating a filter that specifies a drop (with no log) action on all SNAP packets with Ethertype ranges of 0x809B to 0x809B and 0x80F3 to 0x80F3. The hierarchical menu for the field is as follows:

Data link – 802.2 SNAP – 802.2 SNAP Ethertype

See *Configuring Traffic Filters and Protocol Prioritization* for more information about how to construct filters for the bridge.

Specifying AppleTalk Zone Information

This section describes information specific to configuring AppleTalk zone information.

Adding or Removing AppleTalk Zones

When a router initially learns about a new network, it sends out query packets requesting the network's zone information. The router uses this information to update its zone table. However, because routers query for this information only the first time they learn about a network, any changes later made to the network's zone list do not propagate to other routers on the internet.

To add, remove, or change an AppleTalk zone from an AppleTalk interface's zone list or default zone, follow this procedure:

1. **Disable all AppleTalk router interfaces (both Bay Networks and otherwise) that connect to the network for which the zone name change is being applied.**

For example, in Figure 2-4, to add the new zone name Blue to the zone list for Network 1-3, disable AppleTalk Interfaces 1.1, 1.2, and 1.3.

2. **Edit the interface's zone list. See "Configuring AppleTalk Zone Lists" in Chapter 4 for instructions.**

   Make certain that you change the zone list for any other seed routers on the affected network as well.

3. **Wait approximately 10 minutes.**

   This allows all routers on the AppleTalk internet to time out the network and zone information for the network from their zone lists.

Note: To expedite network timeout in an internet containing AURP tunnels, you may need to manually reset AURP connections that have large update intervals.

4. **Reenable the router interfaces that connect to the network.**

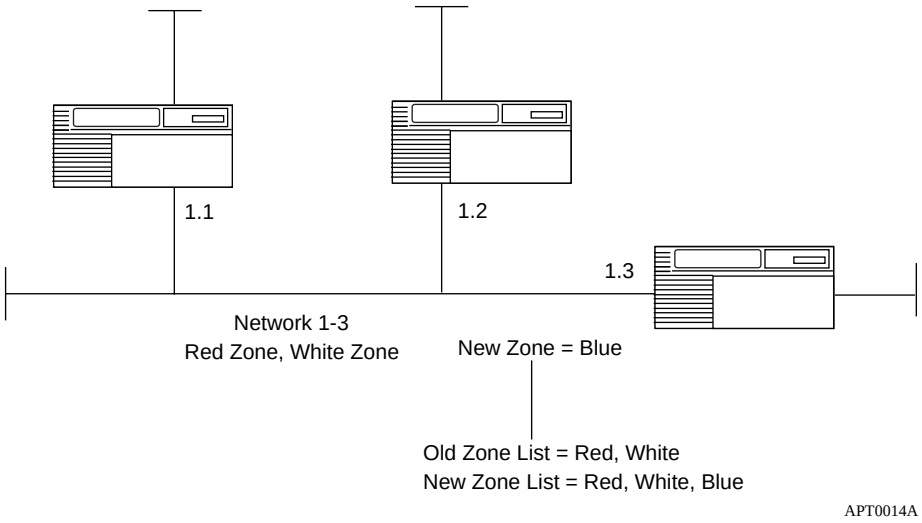


Figure 2-4. Updating an AppleTalk Router's Zone List

Using AppleTalk Zone Filters

Bay Networks AppleTalk zone filters let network administrators control the zone information that Bay Networks routers distribute, providing a level of security unavailable through the standard AppleTalk protocol.

The Bay Networks AppleTalk implementation lets you configure zone filters on a per-interface basis. Use zone filters to

- Impose network security.

  Zone filters can impose security measures by controlling which AppleTalk zones and networks are accessible to endstations on the network.

- Simplify a user's network access.

  Zone filters can screen out unwanted zones and reduce the number of zones on a user's Chooser.

You configure zone filters by constructing an Include, Exclude, 5.X Include, or 5.X Exclude zone filter list for an interface.

- When you configure an Include zone filter list, the interface advertises that it can reach only those zones specified on the list. This type of filter is useful if you want to filter out most of the zones that the router knows about.
- When you configure an Exclude zone filter list, the interface advertises that it can reach all zones except those specified on the list. This type of filter is useful if you want to filter out only a few of the zones that the router knows about.
- When you configure a 5.X Include or 5.X Exclude zone filter list, the interface advertises that it can reach only those zones allowed or denied on the list. However, the interface will advertise all networks, regardless of the zones in its zone filter list.

For instructions on configuring zone filters, see "Configuring AppleTalk Zone Filters" in Chapter 4.

How Zone Filters Work

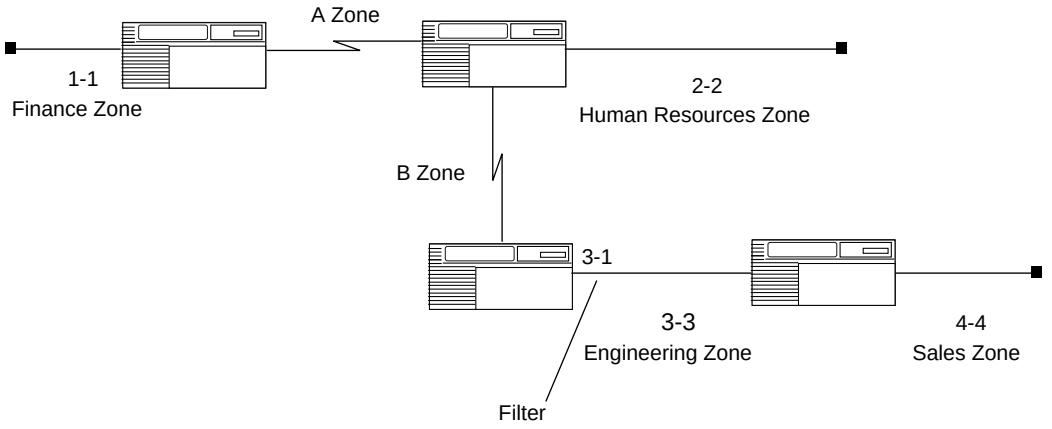
When you configure zone filters on an interface using the Exclude or Include options, the interface no longer sends out zone or network information about the filtered zones.

- RTMP packets the interface generates do not contain the networks mapped to the filtered zones.
- ZIP GetZoneList response packets the interface sends out do not contain the filtered zones.
- NBP Broadcast Request packets the interface receives for the filtered zones are not propagated as Forward Request packets or Lookup packets by the interface.
- NBP Response packets are not routed if the source network number is from a network with a zone that is to be filtered.

When you are using the Exclude or Include options, be aware that if part of a network's zone list is filtered on a port, then the entire network is filtered on that port. Within an AppleTalk network, a router must communicate all zone information about a network if it knows the network's associated zone list.

Note: Communicating a partial zone list for a given network violates the AppleTalk specification and can result in ZIP storms. ZIP storms occur when a router receiving conflicting ZIP information from different sources continuously broadcasts ZIP requests onto locally attached network segments.

For example, the network administrator for the network shown in Figure 2-5 wants to impose a security filter that restricts all AppleTalk users, except those in the Human Resources zone, from accessing the Finance zone. To accomplish this, the administrator adds the Finance zone to the exclude zone filter list for Interface 3.1.



Exclude Zone Filter List	Networks Filtered
Finance	1-1

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Figure 2-5. Configuring Zone Filters with the Exclude Option

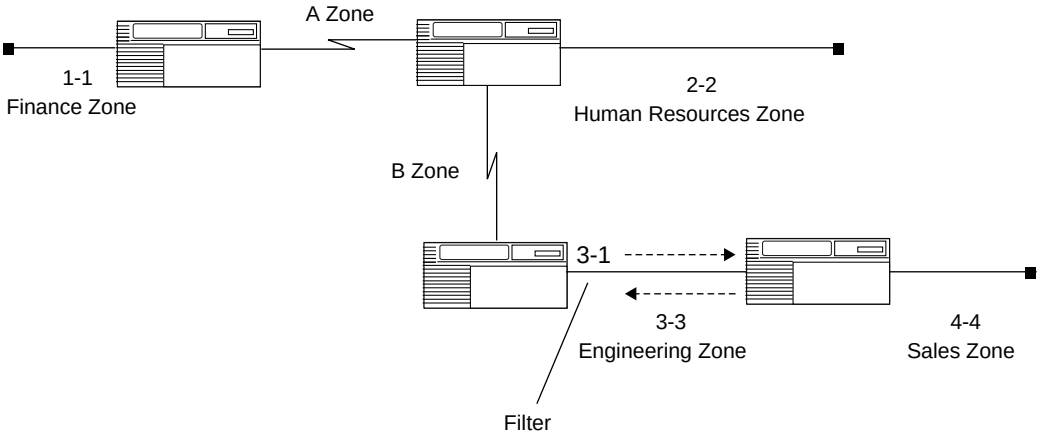
With the filter in place, the RTMP and ZIP packets that Interface 3.1 generates no longer advertise the Finance zone as being reachable. Any NBP Broadcast Request packets the interface receives for the Finance zone are not propagated as Forward Request packets or Lookup packets. As a result, the services of the Finance zone are no longer visible to end users in the Engineering zone and Sales zone.

When you configure zone filters on an interface using the 5.X Exclude or 5.X Include options, the interface no longer sends out zone information about the filtered zones:

- The interface sends out ZIP Reply packets that do not contain the filtered zones. If all the zones for a network are filtered, then the default zone of the filtering interface represents the network. However, if the network being queried is learned on the receiving interface of the ZIP Request packet, then the ZIP Reply packet must contain the correct zone for that network.
- The interface sends out ZIP GetZoneList Response packets that do not contain the filtered zones.
- The interface does not propagate NBP Broadcast Request packets for the filtered zones as Forward Request packets or Lookup packets.

Note: When you are using the 5.X Exclude or 5.X Include option, the interface advertises all networks. The interface may not advertise the network with the complete zone list because some of the zones are filtered. To avoid different sources advertising conflicting ZIP information, the 5.X Exclude and 5.X Include options do not support loop topologies.

For example, the network administrator for the network shown in Figure 2-6 wants to impose a security filter that restricts all AppleTalk users, except those in the Human Resources zone, from accessing the Finance zone. To accomplish this, the administrator adds the Finance zone to the 5.X Exclude zone filter list for Interface 3.1.



5.X Exclude Zone Filter List	Networks Associated with Zones in the Zone Filter List	Zones Advertised for the Network for ZIP Reply
Finance	1-1	Engineering (Default Zone of Interface 3.1)

APT0016A

Figure 2-6. Configuring Zone Filters with the 5.X Exclude Option

With the filter in place, the ZIP packets that Interface 3.1 generates no longer advertise the Finance zone as being reachable. Any NBP Broadcast Request packets that the interface receives for the Finance zone are not propagated as Forward Request packets or Lookup packets. As a result, the services of the Finance zone are no longer visible to end users in the Engineering zone and Sales zone.

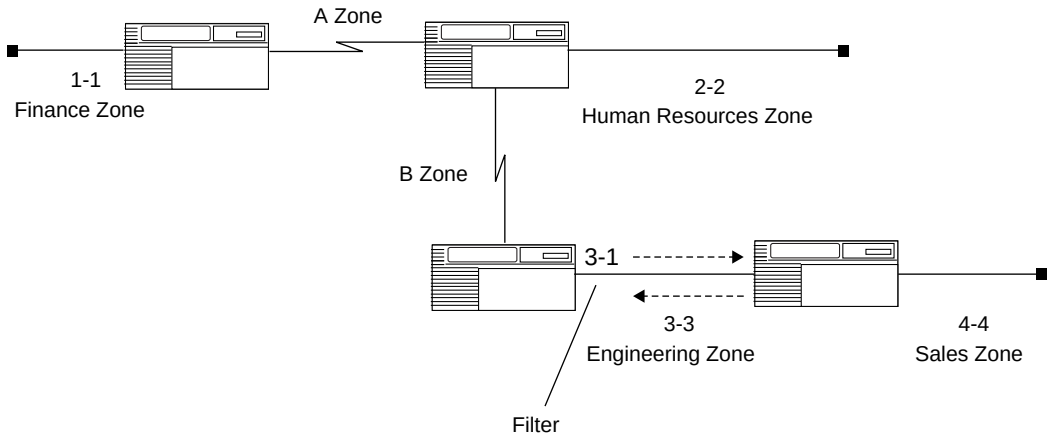
Zone Filter Rules

AppleTalk has several basic filtering rules, or conditions that govern how zone filtering works, depending on whether you use the Exclude, Include, 5.X Exclude, or 5.X Include options, as explained in the following sections.

Zone Filter Rules for the Exclude Option

Rule 1. The AppleTalk router always advertises its own network information.

For example, if the zone filter list shown in Figure 2-7 for Interface 3.1 were expanded to include the Engineering zone, the router would still advertise zone and network information about Network 3-3 through Interface 3.1 in response to a GetZoneList or GetLocalZones command.



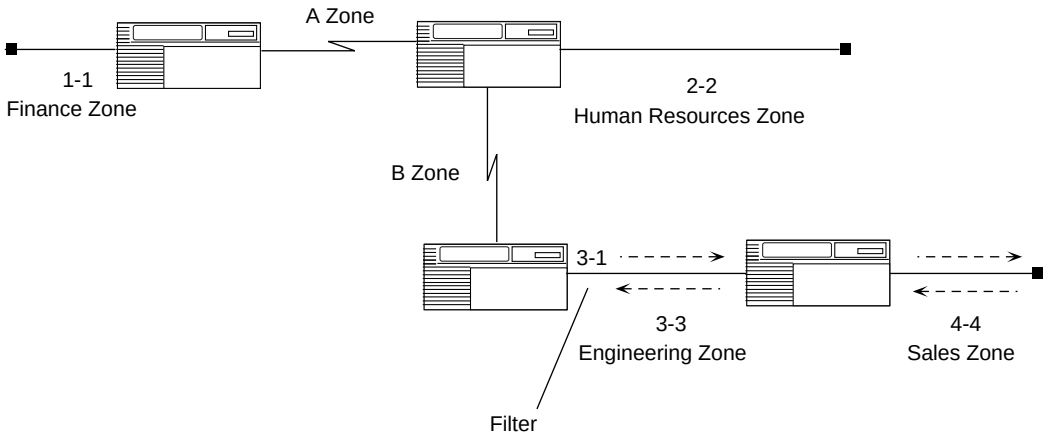
Exclude Zone Filter List	Networks Filtered	Networks not Filtered
Finance	1-1	3-3 due to Rule 1

APT0017A

Figure 2-7. AppleTalk Zone Filters with the Exclude Option: Rule 1

Rule 2. The AppleTalk router always advertises the network information it learns on an interface back out that interface. The AppleTalk router advertises all zone information in response to a GetLocalZones Reply request. The router applies zone filters to corresponding network information in RTMP data packets, ZIP replies, GetZoneList replies, and NBP forward requests.

For example, if the zone filter list shown in Figure 2-8 for Interface 3.1 were expanded to include the Sales zone, the router would still advertise Network 4-4 because it was learned about on Interface 3.1.



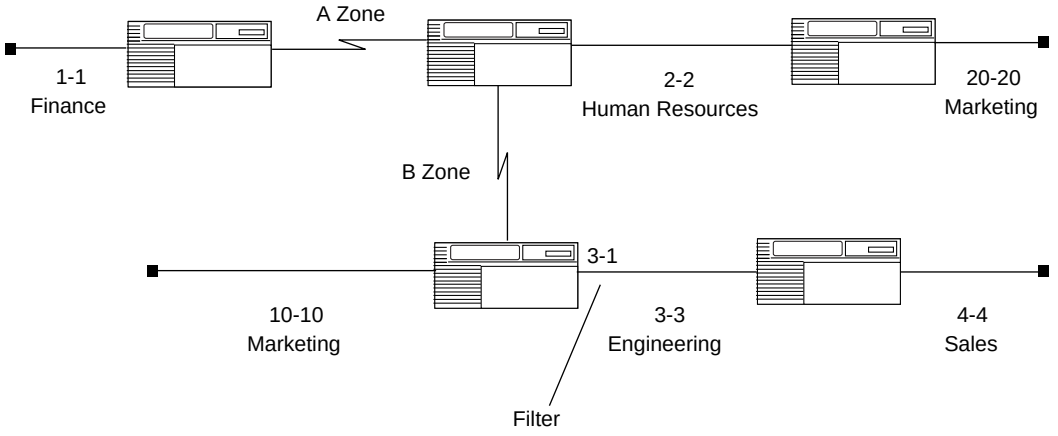
Exclude Zone Filter List	Networks Filtered	Networks not Filtered
Finance, Engineering, Sales	1-1	3-3, due to Rule 1, 4-4 due to Rule 2

APT0018A

Figure 2-8. AppleTalk Zone Filters with the Exclude Option: Rule 2

Rule 3. The AppleTalk router filters out all networks that reside in the filtered zones.

For example, Networks 10-10 and 20-20 shown in Figure 2-9 are both assigned to the Marketing zone. If you add the Marketing zone to the zone filter list for Interface 3.1, then both Network 10-10 and Network 20-20 are filtered out.



Exclude Zone Filter List	Networks Filtered
Marketing	10-10, 20-20

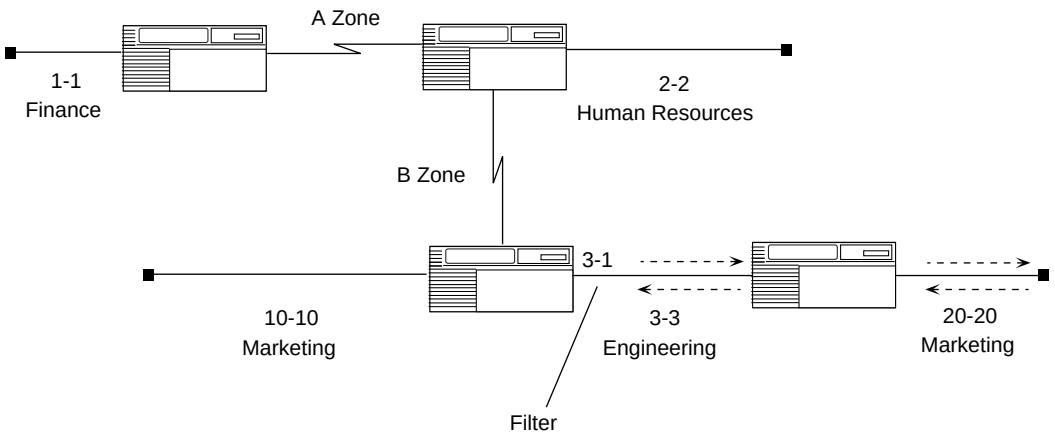
APT0019A

Figure 2-9. AppleTalk Zone Filters with the Exclude Option: Rule 3

Rule 4. Depending on the network configuration, Rule 3 can be amended by Rule 2.

For example, suppose that the network configuration is like the one shown in Figure 2-10. If you add the Marketing zone to the zone filter list for Interface 3.1, the filter behaves differently than in the previous example.

That is, the interface still filters out Network 10-10, because it belongs to the Marketing zone. However, even though Network 20-20 also belongs to the Marketing zone, it is not filtered out because it was learned about on this same interface (conforming to Rule 2).



Exclude Zone Filter List	Networks Filtered	Networks not Filtered
Marketing	10-10	20-20, due to Rule 2

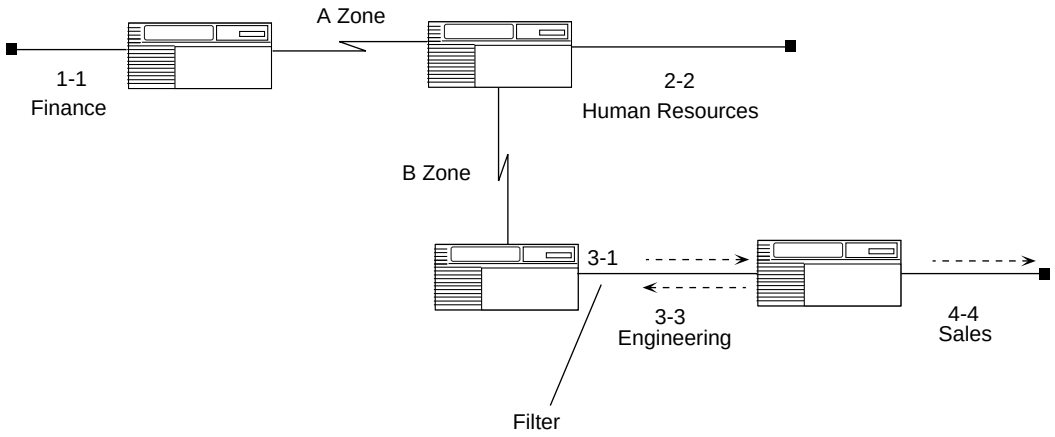
APT0020A

Figure 2-10. AppleTalk Zone Filters with the Exclude Option: Rule 4

Zone Filter Rules for the Include Option

Rule 1. The AppleTalk router always advertises its own network information.

For example, if the Include zone filter list shown in Figure 2-11 for Interface 3.1 includes the Human Resources zone, the router would still advertise zones and network information about Network 3-3 out through Interface 3.1.



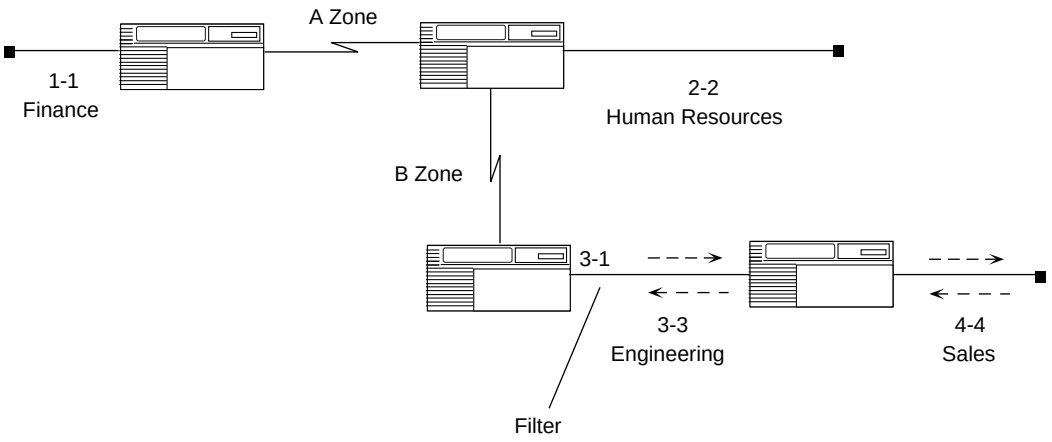
Include Zone Filter List	Networks Advertised	Zones Advertised
Human Resources	2-2 (include list)	Human Resources
	3-3 (Rule 1)	Engineering

APT0021A

Figure 2-11. AppleTalk Zone Filters with the Include Option: Rule 1

Rule 2. The AppleTalk router always advertises the network information it learns on an interface out through that same interface.

For example, if the Include zone filter list shown in Figure 2-12 for Interface 3.1 includes the Human Resources zone, the router would still advertise zone and network information about Network 4-4 out through Interface 3.1.



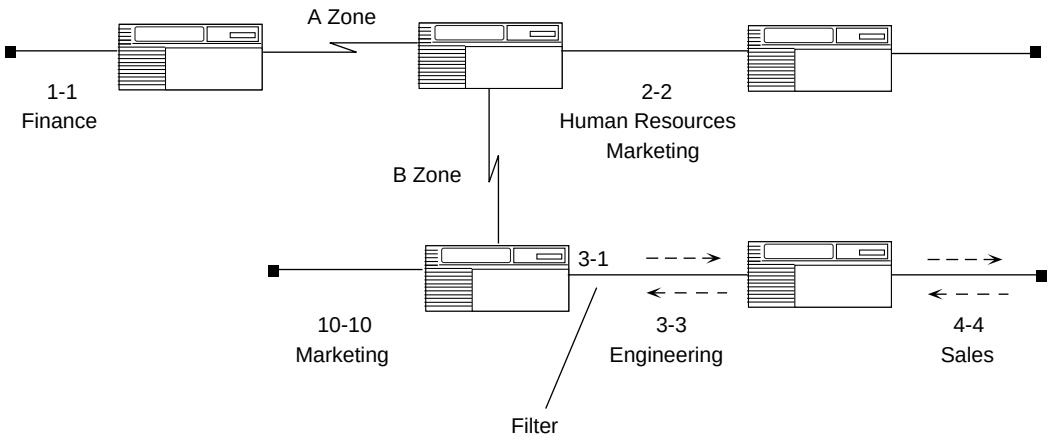
Include Zone Filter List	Networks Advertised	Zones Advertised
Human Resources	2-2 (in Include list)	Human Resources
	3-3 (Rule 1)	Engineering
	4-4 (Rule 2)	Sales

APT0022A

Figure 2-12. AppleTalk Zone Filters with the Include Option: Rule 2

Rule 3. The AppleTalk router advertises all network and zone information for networks that reside in the Include zone list.

For example, if the Include zone filter list shown in Figure 2-13 for Interface 3.1 includes the Human Resources zone, and Network 2-2 is associated with the Human Resources and Marketing zones, the router would advertise all zones assigned to Network 2-2 out through Interface 3.1.



Include Zone Filter List	Networks Advertised	Zones Advertised
Human Resources	2-2 (in Include list)	Human Resources Marketing (Rule 3)
	3-3 (Rule 1)	Engineering
	4-4 (Rule 2)	Sales

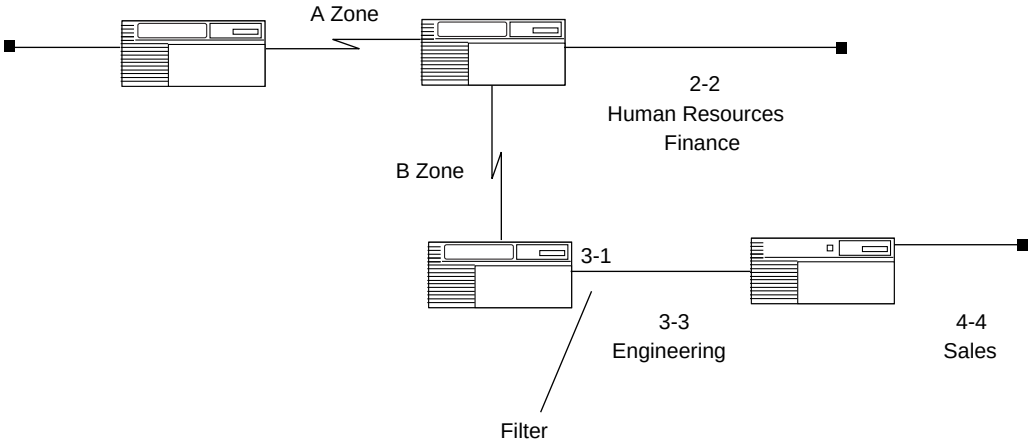
APT0023A

Figure 2-13. AppleTalk Zone Filters with the Include Option: Rule 3

Zone Filter Rules for the 5.X Exclude Option

Rule 1. The AppleTalk router always advertises its own network information.

For example, if the 5.X Exclude zone filter list shown in Figure 2-14 for Interface 3.1 includes the Finance and Engineering zones, the router would still advertise zone and network information about Network 3-3 out through Interface 3.1.



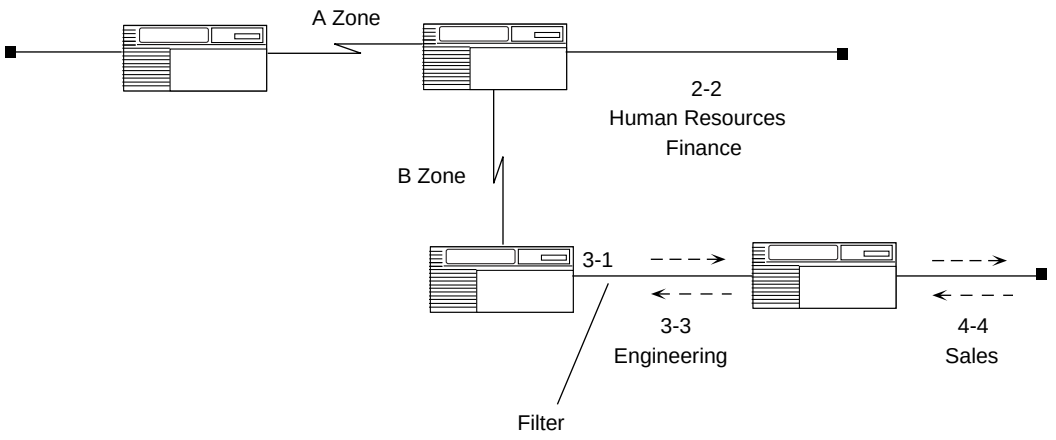
5.X Exclude Zone Filter List	Networks Advertised	Zones Advertised
Finance, Engineering	2-2	Human Resources (not in 5.X Exclude list)
	3-3	Engineering (Rule 1)

APT0024A

Figure 2-14. AppleTalk Zone Filters with the 5.X Exclude Option: Rule 1

Rule 2. The AppleTalk router always advertises the network information it learns on an interface out through that same interface.

For example, if the 5.X Exclude zone filter list shown in Figure 2-15 for Interface 3.1 includes the Finance, Engineering, and Sales zones, the router would still advertise zone and network information about Network 4-4 out through Interface 3.1.



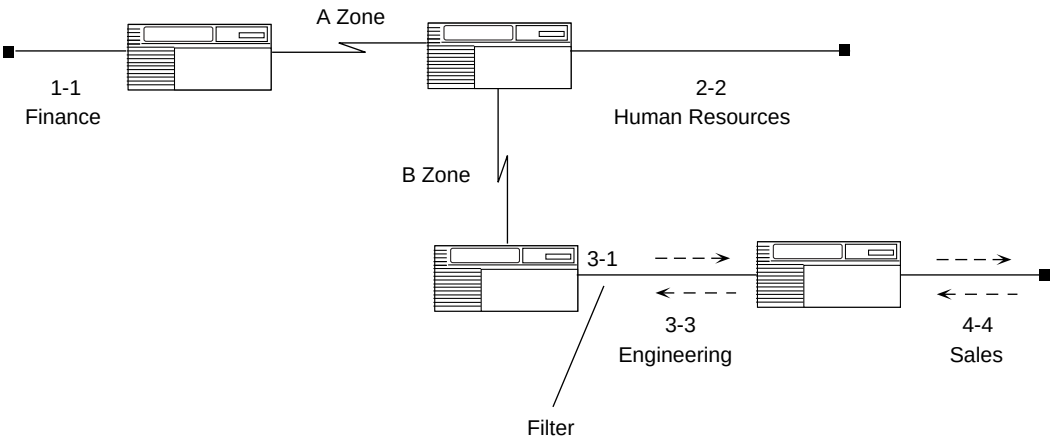
5.X Exclude Zone Filter List	Networks Advertised	Zones Advertised
Finance, Engineering, Sales	2-2	Human Resources (not in 5.X Exclude list)
	3-3	Engineering (Rule 1)
	4-4	Sales (Rule 2)

APT0025A

Figure 2-15. AppleTalk Zone Filters with the 5.X Exclude Option: Rule 2

Rule 3. The AppleTalk router advertises all networks. If the 5.X Exclude zone filter list specifies all of the zones associated with a network, the router would advertise that network with the default zone of the filtering interface.

For example, if the 5.X Exclude zone filter list shown in Figure 2-16 for Interface 3.1 includes the Finance, Engineering, and Sales zones, the router would still advertise Network 1-1 out through Interface 3.1, except that the router would advertise the default zone of Interface 3.1, Engineering, with Network 1.1.



5.X Exclude Zone Filter List	Networks Advertised	Zones Advertised
Finance, Engineering, Sales	2-2	Human Resources (not in 5.X Exclude list)
	3-3	Engineering (Rule 1)
	4-4	Sales (Rule 2)
	1-1	Engineering (Default Zone of Interface 3.1, Rule 3)

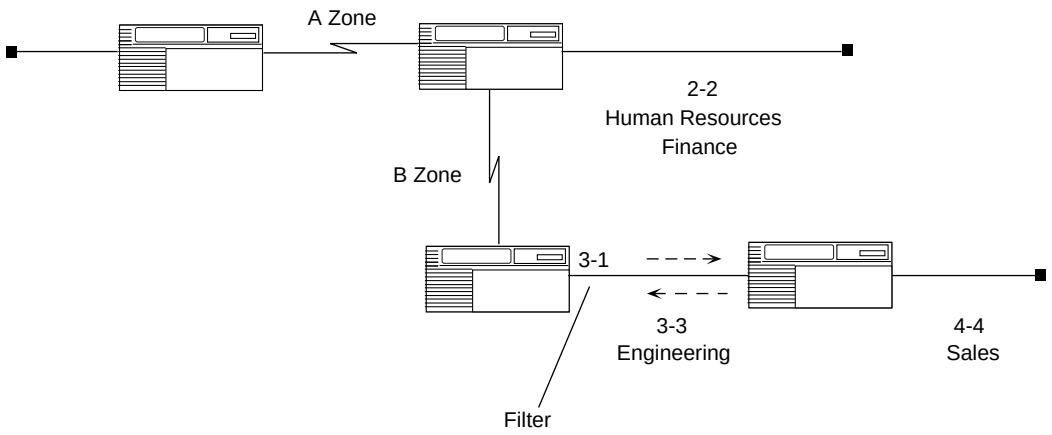
APT0026A

Figure 2-16. AppleTalk Zone Filters with the 5.X Exclude Option: Rule 3

Zone Filter Rules for the 5.X Include Option

Rule 1. The AppleTalk router always advertises its own network information.

For example, if the 5.X Include zone filter list shown in Figure 2-17 for Interface 3.1 includes the Human Resources zone, the router would still advertise zone and network information about Network 3-3 out through Interface 3.1.



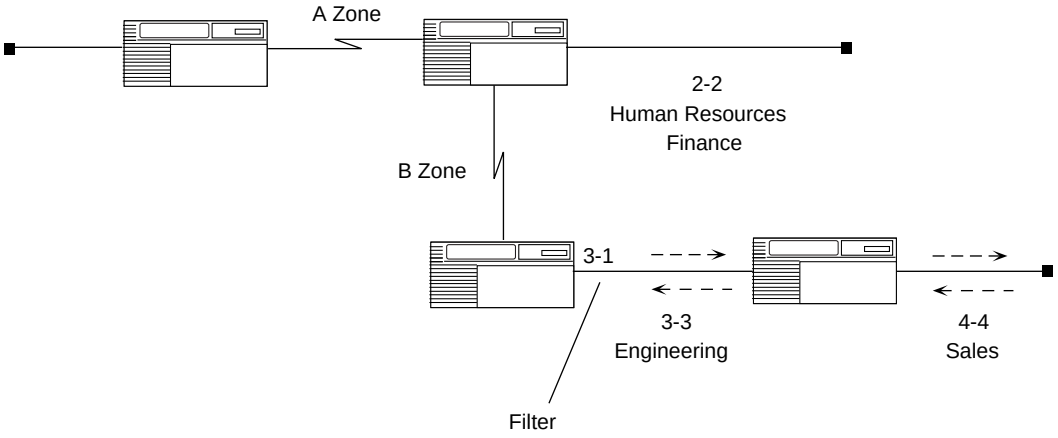
5.X Include Zone Filter List	Networks Advertised	Zones Advertised
Human Resources	2-2	Human Resources (in 5.X Include list)
	3-3	Engineering (Rule 1)

APT0027A

Figure 2-17. AppleTalk Zone Filters with the 5.X Include Option: Rule 1

Rule 2. The AppleTalk router always advertises the network information it learns on an interface out through that same interface.

For example, if the 5.X Include zone filter list shown in Figure 2-18 for Interface 3.1 includes the Human Resources zone, the router would still advertise zone and network information about Network 4-4 out Interface 3.1.



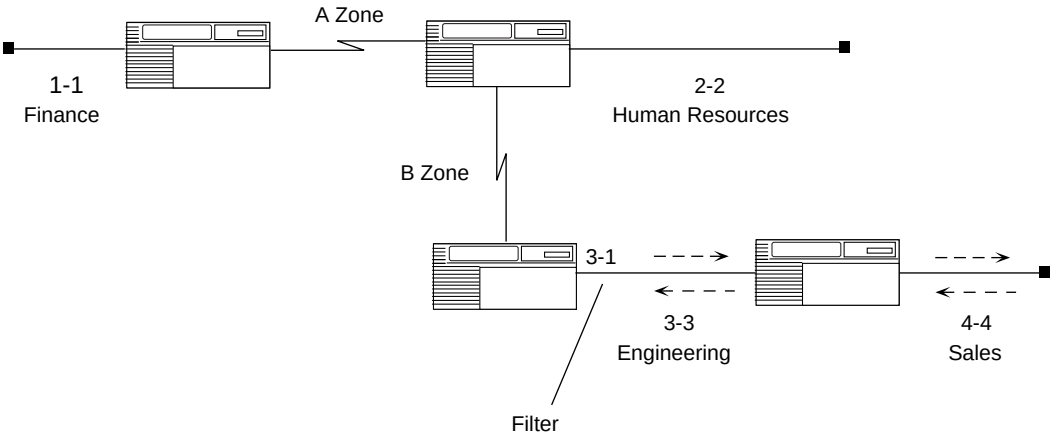
5.X Include Zone Filter List	Networks Advertised	Zones Advertised
Human Resources	2-2	Human Resources (in 5.X Include list)
	3-3	Engineering (Rule 1)
	4-4	Sales (Rule 2)

APT0028A

Figure 2-18. AppleTalk Zone Filters with the 5.X Include Option: Rule 2

Rule 3. The AppleTalk router advertises all networks. If the 5.X Include zone list specifies none of the zones associated with a network, the default zone of the filtering interface is advertised with that network.

For example, if the 5.X Include zone filter list shown in Figure 2-19 for Interface 3.1 includes the Human Resources zone, the router would still advertise Network 1-1 out through Interface 3.1, except that the router would advertise the default zone of Interface 3.1, Engineering, with Network 1-1.



5.X Include Zone Filter List	Networks Advertised	Zones Advertised
Human Resources	2-2	Human Resources (in 5.X Include list)
	3-3	Engineering (Rule 1)
	4-4	Sales (Rule 2)
	1-1	Engineering (Default Zone of Interface 3.1, Rule 3)

APT0029A

Figure 2-19. AppleTalk Zone Filters with the 5.X Include Option: Rule 3

AppleTalk Network Topology Information

This section describes information specific to AppleTalk network topologies.

Configuring the AppleTalk Router to Source Route over Token Ring Networks

The Bay Networks AppleTalk router supports routing over Token Ring networks that contain one or more source-routing bridges.

In a Source Routing network, every endstation that sends out a frame supplies the frame with the necessary route descriptors so that it can be source routed across the network. Thus, for routers to route packets across a Source Routing network, they must act like endstations, supplying route descriptors for each packet before they send the packet out onto the network (Figure 2-20).

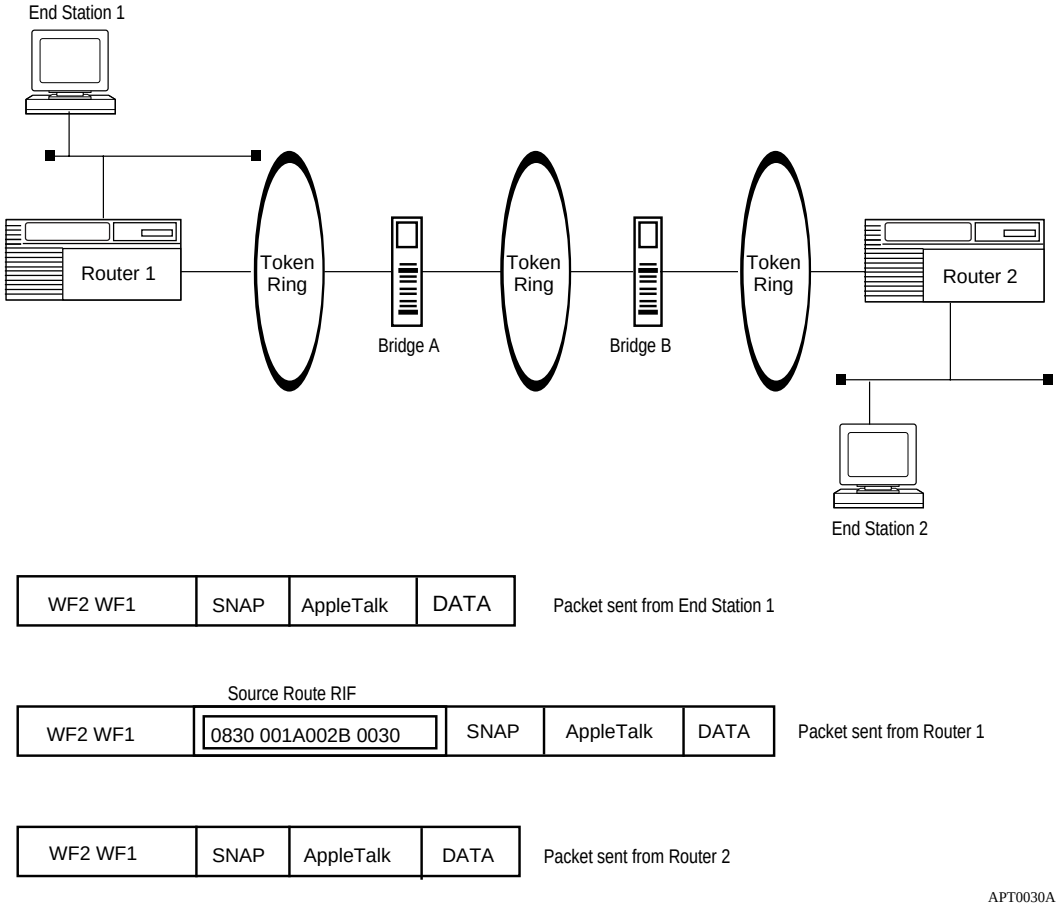


Figure 2-20. AppleTalk Routers Source Routing across a Token Ring Network

With end-node support enabled, whenever a Bay Networks AppleTalk router receives a packet and determines that the packet's next hop is located across a Source Routing network, the router does the following:

- Adds the necessary RIF information to the packet's MAC header
- Sends the packet out onto the network where it is source routed toward the next hop

Upon receiving the packet from the Token Ring network, the peer router strips off the RIF field and continues to route the packet toward the destination network address.

You configure source route end-node support for each individual routing protocol on a per-circuit basis. See "Editing AppleTalk Interface Parameters" in Chapter 4 for instructions.

Configuring the AppleTalk Router in a Non-Fully Meshed Frame Relay Topology

If an AppleTalk interface connects to a non-fully meshed Frame Relay topology, and you want all of the routers connecting to the Frame Relay network to learn about each other, then you must

- Set the Enable Split Horizon parameter for this interface to Disable.
- Statically configure the Network ID and Node ID for each AppleTalk interface connecting to the Frame Relay network.

A non-fully meshed network is a WAN in which one or more routers do not have logically direct connections to all other routers. Figure 2-21 shows a sample non-fully meshed network with Split Horizon disabled. (A fully meshed network is a WAN in which all routers have a logically direct connection to each other.)

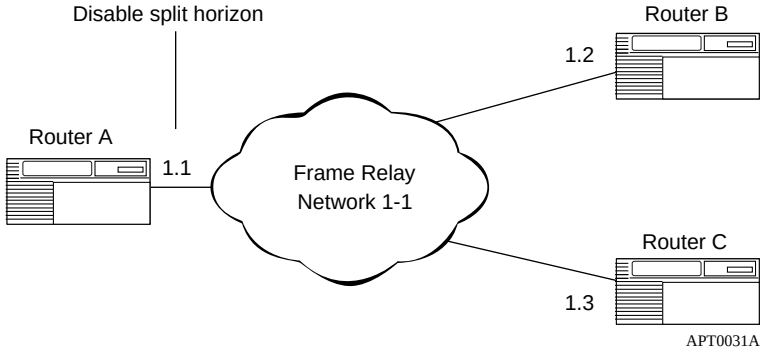


Figure 2-21. AppleTalk Routers in a Non-Fully Meshed Frame Relay Topology

For example, if you enable Split Horizon on Interface 1.1, then Router A learns about Router B and Router C; however, Router B does not learn about Router C (and vice versa). For all routers to learn about each other, you must disable Split Horizon for Interface 1.1, and you must statically configure Network ID and Node ID for Interfaces 1.1, 1.2, and 1.3.

See “Editing AppleTalk Interface Parameters” in Chapter 4 for instructions on how to set the Enable Split Horizon, Network ID, and Node ID parameters.

Reducing Excess Routing Traffic on a Large AppleTalk Network

If you are adding Bay Networks AppleTalk routers to a large internet (such as one that has more than 200 routers and networks), consider the following network configuration tips to reduce the amount of routing traffic on your network:

- Keep the physical network topology as hierarchical as possible. Using a functional (organizational) hierarchy isolates groups on the network and reduces the amount of excess broadcast traffic.
- Reduce the number of devices on a single physical network (or bridged network) by dividing the internet into a greater number of networks. This also helps to reduce the amount of traffic that is broadcast to all nodes on the network.
- Limit the amount of Name Binding Protocol traffic on the network; avoid configuring the same zone on multiple networks. Instead, keep the ratio of zones to networks as close to 1:1 as possible.

Adding a Bay Networks AppleTalk Router to a Transitional Network

You can add the Bay Networks AppleTalk router to a transitional network (one that generates both AppleTalk Phase 1 and AppleTalk Phase 2 traffic). For performance reasons, however, we do not recommend it.

If you choose to add the Bay Networks AppleTalk router to a transitional network, you must consider the following configuration requirements:

- An AppleTalk Phase 1 to Phase 2 transitional router must reside on the internet.
- All defined network ranges must consist of a single number; for example, 1-1 is a valid network range, while 1-5 is invalid.
- You can only specify a single zone name for each network.

AURP Information

Before configuring AURP on a router, you must configure AppleTalk on at least one of the router's circuits. Then you can use AURP to create a wide-area link between two or more AppleTalk networks.

Unlike other AppleTalk protocols, AURP does not require you to configure any circuits for AURP services. Use AURP to configure the router's interface to another router that is set up for AURP services (known as the *peer IP address)*.

Deciding When to Use AURP

You may find AURP desirable when faced with one of the following scenarios:

- You want to link two or more AppleTalk networks across an existing IP internet.
- You want to reduce the amount of RTMP traffic on an AppleTalk network.
- You have a large AppleTalk network that is approaching the 15-hop AppleTalk limit.

If possible, use AURP without RTMP in a nonloop topology.

Note that AURP supports the following AppleTalk commands over the IP connecting network:

- Open request and response
- Routing Info request, response, and ack
- Zone Information request and response
- Router down notification
- Tickle and Tickle ack (based on configurable timer)

AURP does not support the following AppleTalk commands over the IP connecting network:

- GetDomainZoneList request and response
- GetZonesNet request and response

In addition, the following features are not available in the Bay Networks implementation of AURP:

- Loop detection
- Network number remapping
- Configured alternative backup paths
- Network hiding

The following sections provide general guidelines for understanding and using some of the most important AURP parameters.

Setting the Update Rate

You should carefully consider how often you want to update your AppleTalk network. A smaller update rate (for example, 10 seconds) causes routers to converge more quickly on a network, making most changes to the network appear quickly in the Chooser application. Though a smaller update rate provides users with quick access to any zones added to a network, it may also prove to be expensive (for example, in a dial-on-demand configuration, or over Frame Relay).

A larger update rate (for example, 1 hour) causes routers to converge less quickly, making changes to the network appear less quickly in the Chooser application. Zones may still appear in the Chooser even though their associated networks are no longer reachable across the tunnel. Also, new network information does not become accessible until the update occurs. This could prove frustrating for some users.

For information on editing the Update Rate parameter, refer to "Editing AURP Parameters" in Chapter 4.

AURP uses the following packets to update its AppleTalk routing information:

- Routing Information Update (RI-Upd)
- Routing Information Request (RI-Req)
- Routing Information Response (RI-Rsp)
- Routing Information Acknowledgment (RI-Ack)
- Zone Information Request (ZI-Req)
- Zone Information Response (ZI-Rsp)

Setting the Last Heard From Timeout

The AppleTalk router uses the Last Heard From Timeout parameter to periodically check that the other end of the connection is up. If the router does not receive an RI-Upd, RI-Rsp, or ZI-Rsp packet within the Last Heard From Timeout period, it sends a Tickle Request and expects a Tickle Acknowledgment.

If the router does not receive the acknowledgment within the Command Timeout period, the router repeats its Tickle Request up to the Command Retries amount. If the router does not receive an acknowledgment, the connection is closed.

A large Last Heard From Timeout value may postpone the discovery of a failed connection by an exterior router. If you are using AURP to create an AppleTalk wide area network, you may want to increase the value to an hour (3600 seconds) if the WAN is relatively stable. However, if you know a network may be unstable, you may want to decrease this value to as little as 30 seconds to ensure that you are aware of any disruptions in service.

For information on editing the Last Heard From Timeout parameter, refer to "Editing AURP Parameters" in Chapter 4.

Setting the Hop Count Reduction

Enable hop count reduction only when the diameter of your network is greater than 15 hops.

If you use hop count reduction, make sure you do not create a network loop like the one shown in Figure 2-22. Hop count reduction can only take place across two AppleTalk networks that are linked by an AURP tunnel.

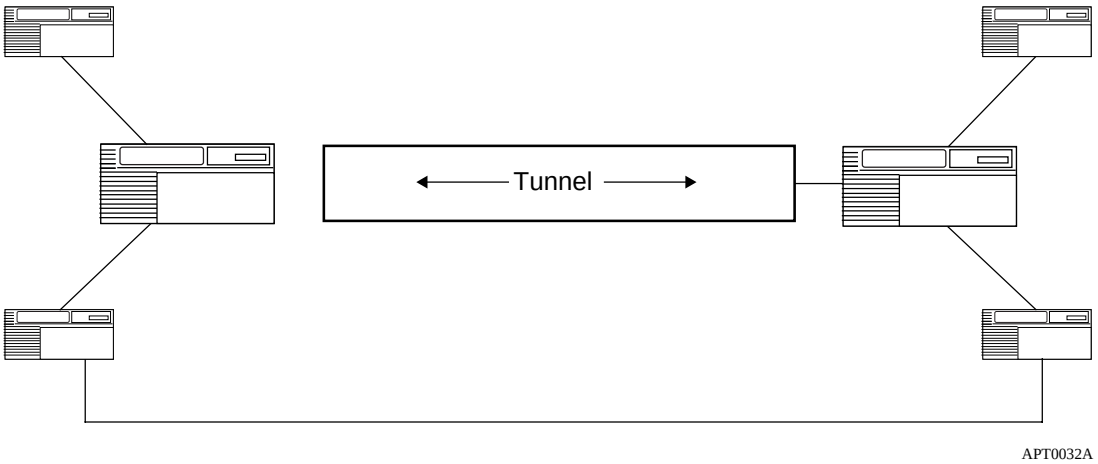


Figure 2-22. Network Loop

For information on editing the Hop Count Reduction parameter, refer to “Editing AURP Parameters” in Chapter 4.

Setting the Command Timeout and Command Retries

The Command Timeout specifies the amount of time to wait for an acknowledgment before retrying the command. The Command Retries parameter specifies how many attempts are made before the connection is considered closed. For a typical network (that is, a network that is relatively stable), the recommended Command Timeout value is 3 seconds. If a network is busy or requires long-distance travel, larger values may be required.

For information on editing the Command Timeout and Command Retries parameters, refer to “Editing AURP Parameters” in Chapter 4.

Setting Zone Filters

See the section “Specifying AppleTalk Zone Information” in this chapter. AURP zone filters work the same way as AppleTalk zone filters.

Setting the Interface Cost

See the section “Specifying Interface Costs” in this chapter. The AURP interface cost parameter works the same way as the AppleTalk Interface Cost parameter.

AppleTalk Dial-on-Demand Routing

In addition to supporting standard AURP functionality, Bay Networks software enables users to combine AURP and IP dial-on-demand routing to provide dial-on-demand routing for AppleTalk networks. This service allows the Bay Networks router to activate the physical connection for a circuit only when retransmitting data over the line, thus significantly reducing your line costs.

The dial-on-demand service enables more efficient use of modems. Because modems usually require between 30 and 60 seconds to make a connection, you must increase AURP’s default timeout and retry values if you intend to use a modem.

To enable AppleTalk dial-on-demand routing with Bay Networks software, use Site Manager to modify the following configuration parameters:

1. **Configure all the necessary parameters for IP dial-on-demand routing on the WAN interface being used for AppleTalk dial-on-demand routing.**
2. **Configure the AURP connection(s) for traffic using the WAN interface configured for dial-on-demand routing with the following parameters defined:**
    a. **Modify the AppleTalk timeout and retry intervals (the default is three tries with a 3-second interval) to slightly exceed the connect delay characteristics of the modem being used for dial-on-demand routing.**

       For example, if the modem takes 45 seconds to connect, set the timeout and retry parameters so that the AURP connection does not time out before the modem connects; for example, eight tries with an 8-second interval between tries (a total of 64 seconds, which exceeds the 45-second modem timeout).

b. **Set the AURP Update Rate timer to a large value to prevent topology change information from initiating a dial-on-demand session.**

   A small value (for example, 5 minutes) could potentially result in a call every 5 minutes, depending on the stability of the network. A larger value (for example, 24 hours) results in fewer calls due to routing updates, but also greatly increases the amount of time before the peer router (and other routers in its local internet) learns about network changes over the tunnel.

c. **Increase the AURP Last Heard From Timeout interval to a high value to prevent Tickle packets from initiating a dial-on-demand connection.**

   The AURP connection attempts to send a Tickle if it has not heard from the peer within this interval. A Last Heard From Timeout of 24 hours results in (at least) one call per day.

For more information on configuring dial-on-demand services, see *Configuring Dial Services*.

Chapter 3
Enabling AppleTalk Services

This chapter describes how to enable AppleTalk services. It assumes you have read *Configuring and Managing Routers with Site Manager* and that you have

1. Opened a configuration file
2. Specified router hardware if this is a local mode configuration file
3. Selected the link or net module connector on which you are enabling AppleTalk, or configured a WAN circuit if this connector requires one

When you enable AppleTalk services, you must configure a subset of all AppleTalk parameters. The Configuration manager supplies default values for the remaining parameters. If you want to edit these default values, refer to Chapter 4.

For each AppleTalk parameter, this manual provides information about default settings, valid parameter options, the parameter function, instructions for setting the parameter, and the Management Information Base (MIB) object ID.

The Technician Interface lets you modify parameters by issuing **set** and **commit** commands that specify the MIB object ID. This process is equivalent to modifying parameters using Site Manager. For more information about using the Technician Interface to access the MIB, refer to *Using Technician Interface Software*.

Caution: The Technician Interface does not verify that the value you enter for a parameter is valid. Entering an invalid value can corrupt your configuration.

Enabling AppleTalk on an Interface

If you enable AppleTalk routing services on an interface, the AppleTalk Interface Configuration window appears (Figure 3-1).

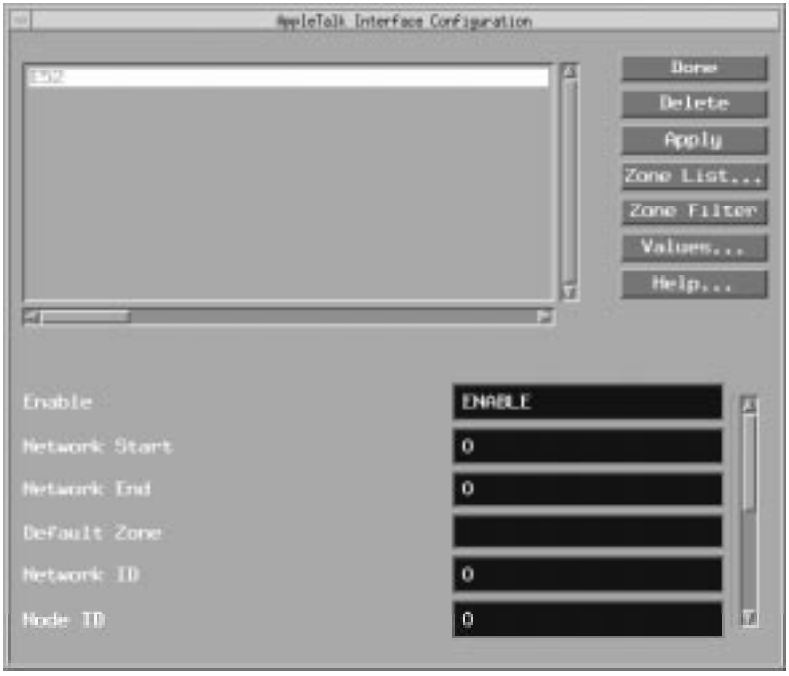


Figure 3-1. AppleTalk Interface Configuration Window

Specify whether this interface functions as a *seed* or *nonseed* router:

- A seed router supplies the Network Start, Network End, Default Zone, and Zone List information for all other nonseed routers on this network. Each network must contain at least one seed router. To configure a seed router interface, specify the Network Start, Network End, and Default Zone and Zone List (if multiple zones are to be configured on this interface). Then click on Apply, followed by Done. See the parameter descriptions that follow.
- A nonseed router acquires its Network Start, Network End, Default Zone, and Zone List information from the other seed routers on the network. To configure a nonseed router interface, simply accept all of the default parameters and click on Done.

For information on editing all of the parameters in the AppleTalk Interface Configuration window, refer to Chapter 4.

Parameter: **Network Start**

Default: 0

Options: 0 to 65279

Function: Specifies the lower boundary (minimum) of the range of network numbers available for use by nodes on the network to which this interface connects.

This parameter's setting determines whether this interface functions as a seed or nonseed router.

Instructions: To configure this interface as a nonseed router, accept the default, 0.

To configure this interface as a seed router, specify this parameter as follows:

– If this is the only seed router on the network, determine the network range for this interface, and enter the lower boundary network number.

– If there are already seed routers on the network, enter the *same* Network Start value that is configured on all other seed routers.

MIB Object ID: 1.3.6.1.4.1.18.3.5.4.3.1.13

Note: If you specify a Network Start other than the default, 0, the router automatically becomes a seed router and you must also specify values for the Network End and Default Zone parameters.

Parameter:	**Network End**
Default:	0
Options:	0 to 65279
Function:	Specifies the upper boundary (maximum) of the range of network numbers available for use by nodes on the network to which this interface connects. You use this parameter with the Network Start parameter to help define a seed router. *If you have not specified a Network Start for this interface, this parameter is ignored.*
Instructions:	To configure this interface as a nonseed router, accept the default, 0. To configure this interface as a seed router, specify the Network End as follows: – If this is the only seed router on the network, determine the network range for this interface, and enter the upper boundary network number. – If there are already seed routers on the network, enter the *same* Network End value that is configured on all other seed routers.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1.14

Parameter:	**Default Zone**
Default:	None
Options:	Any valid zone name
Function:	Specifies the name of the default zone to which all new nodes are assigned when they first start up on this network. This parameter is used in conjunction with the Network Start and Network End parameters to help define a seed router. *If you have not specified a Network Start for this interface, this parameter is ignored.*
Instructions:	To configure this interface as a nonseed router, leave this field blank. To configure this interface as a seed router, specify the Default Zone as follows: – If this is the only seed router on the network, enter any valid Default Zone name. – If there are already seed routers on the network, enter the *same* Default Zone name as is configured on all other seed routers. A valid zone name can consist of a maximum of 32 characters and can include any character except an asterisk (*). See “Using Nonprintable Characters in AppleTalk Zone Names” in this chapter.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1.15

Configuring the Zone List

To configure a Zone List, you must add zones to the list, as follows:

1. **Click on Zone List in the AppleTalk Interface Configuration window (Figure 3-1).**

   The AT Zone Configuration window appears (Figure 3-2).

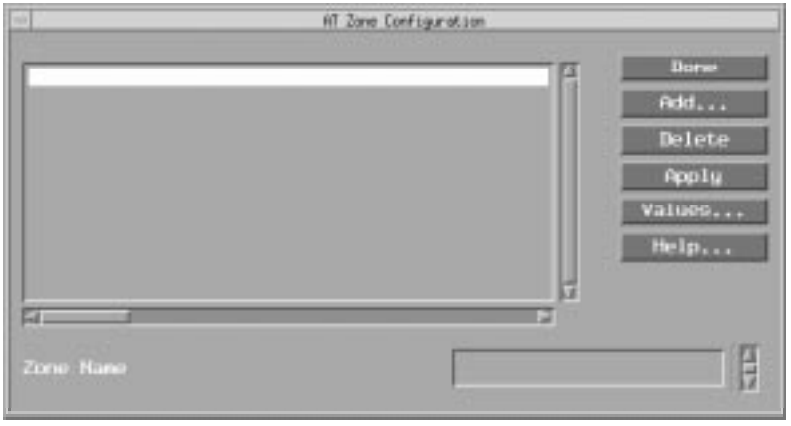


Figure 3-2. AT Zone Configuration Window

2. **Click on Add.**

   The AppleTalk Zone Configuration window appears (Figure 3-3).

Figure 3-3. AppleTalk Zone Configuration Window

3. **Enter a name for the zone in the Zone Name box and click on OK.**

   You return to the AT Zone Configuration window.

4. **Either repeat steps 2 and 3 for each zone you want to add, or click on Done to exit the window.**

Note: The default zone should not appear in the Zone List.

Using Nonprintable Characters in AppleTalk Zone Names

Note: To enter nonprintable characters in AppleTalk zone names, you must access the Configuration Manager tool in local or remote mode. You cannot enter nonprintable characters if you are using dynamic mode.

Using nonprintable characters in AppleTalk zone names requires some additional steps. Enter nonprintable characters into the Default Zone field or Zone Name field as follows:

1. **Type *xx*, where *xx* is the two-hexadecimal-digit representation of each nonprintable character, as shown in the AppleTalk character set mapping.**

   Refer to the Character Set Mapping table in *Inside AppleTalk. 2d ed.* (Cupertino, Calif.: Apple Computer), 1990. The router counts the *xx* as a single character.

   Type two backslashes (\\) to indicate a literal backslash. The router counts \\ as a single character.

2. **Click on Apply.**
3. **Save the configuration.**
4. **Transfer the configuration file to the router, using the Router Files Manager tool if the Configuration Manager is in local configuration mode.**
5. **Reboot the router with the new configuration file.**

Caution: Nonprintable characters in these parameters appear as different characters when you transfer the file to the router and reopen it using the Configuration Manager. SNMP translates the characters when transferring the configuration to Site Manager.

To edit Default Zone or Zone List parameters where you previously saved nonprintable characters, overtype the zone name and retype the nonprintable characters, following the steps in this section.

Configuring AURP

Before configuring AURP on a router, you must configure AppleTalk on at least one of the router's circuits. Once you have configured an AppleTalk interface, you can use AURP to create a wide-area link between two or more AppleTalk networks.

To configure AURP global parameters, begin at the Configuration Manager window:

1. **Select Protocols > AppleTalk > AURP > Global.**

   The Edit Apple AURP Global Parameters window appears (Figure 3-4).

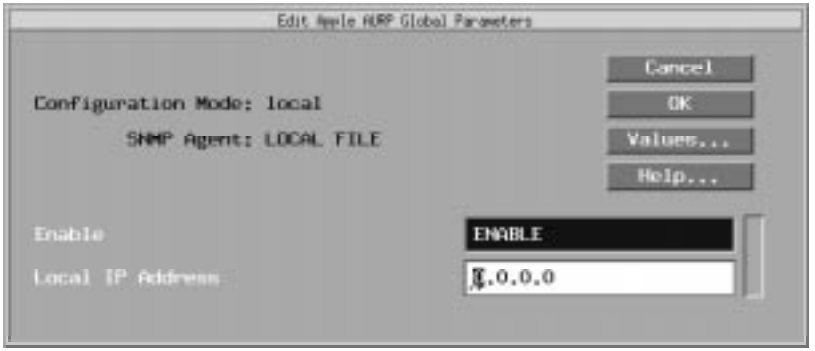


Figure 3-4. Edit Apple AURP Global Parameters Window

2. **Set the Enable parameter to Enable.**

3. **Enter the appropriate IP address (using dotted-decimal notation) in the Local IP Address field.**
4. **Click on OK to exit the window and save your changes when you are finished.**

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables AURP on the router.
Instructions:	Set to Enable to globally enable AURP.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.8.2

Parameter:	**Local IP Address**
Default:	None
Options:	Any valid 32-bit IP address in dotted decimal notation
Function:	Identifies an IP interface on the router. This is the IP interface used for AURP.
Instructions:	Enter the IP address of the interface on this router that AURP should use.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.8.5

To configure the AURP *connection*, enter the IP address for the remote peer. To do this, begin at the Configuration Manager window:

1. **Select Protocols** > **AppleTalk** > **AURP** > **Interfaces.**

   The AT AURP Interface Configuration window appears (Figure 3-5).

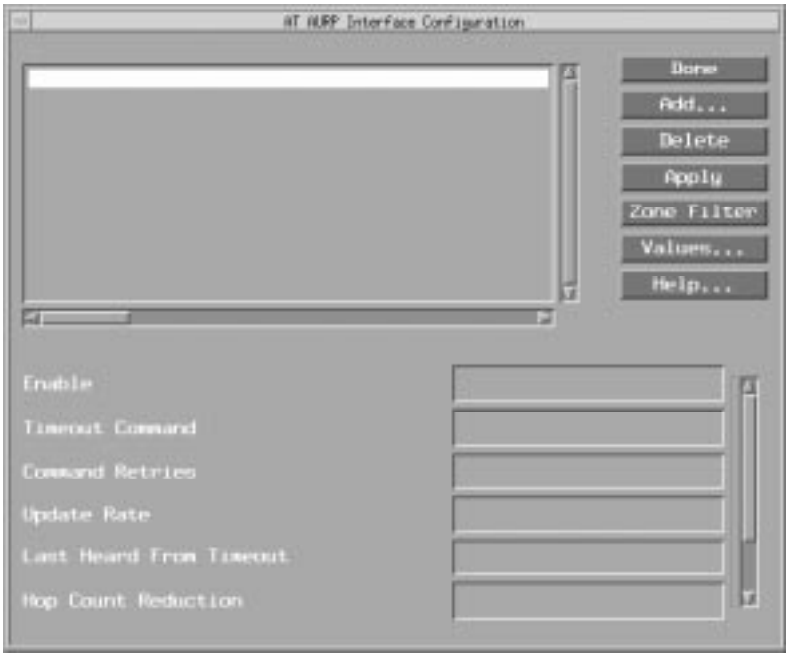


Figure 3-5. AT AURP Interface Configuration Window

2. **Click on Add.**

   The AppleTalk AURP Configuration window appears (Figure 3-6).

Figure 3-6. AppleTalk AURP Configuration Window

3. **Enter the appropriate IP address in the Remote AURP IP Address field and click on OK.**

   The AT AURP Interface Configuration window reappears.

4. **Repeat steps 2 and 3 to add additional remote peers to the AURP connection.**

5. **Click on Done to exit the window.**

For information on customizing AURP service or configuring AURP zone filter lists, refer to Chapter 4.

Parameter:	**Remote AURP IP Address**
Default:	None
Options:	Any valid 32-bit IP address
Function:	Identifies the peer's IP address for the AURP connection.
Instructions:	Enter an IP address using dotted decimal notation.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1.14

Chapter 4
Editing AppleTalk Parameters

Once you have enabled an AppleTalk interface, you can use Site Manager to edit AppleTalk parameters and customize AppleTalk services.

Use Site Manager to

- Edit AppleTalk global parameters
- Edit AppleTalk interface parameters
- Configure AppleTalk zone lists
- Change the AppleTalk Default Zone
- Configure AppleTalk zone filters
- Select the Name Binding Protocol interface
- Globally delete AppleTalk
- Edit AURP global parameters
- Edit AURP interface parameters
- Edit the AURP zone filter list

Accessing AppleTalk Parameters

You can access and edit the AppleTalk parameters for all AppleTalk interfaces configured on the router.

Note: Before you can edit the parameters, you must have already configured at least one AppleTalk interface. To configure an AppleTalk interface, or to add additional interfaces, refer to Chapter 3.

You access all AppleTalk parameters from the Configuration Manager window (Figure 4-1). Refer to *Configuring and Managing Routers with Site Manager* for instructions on accessing this window.

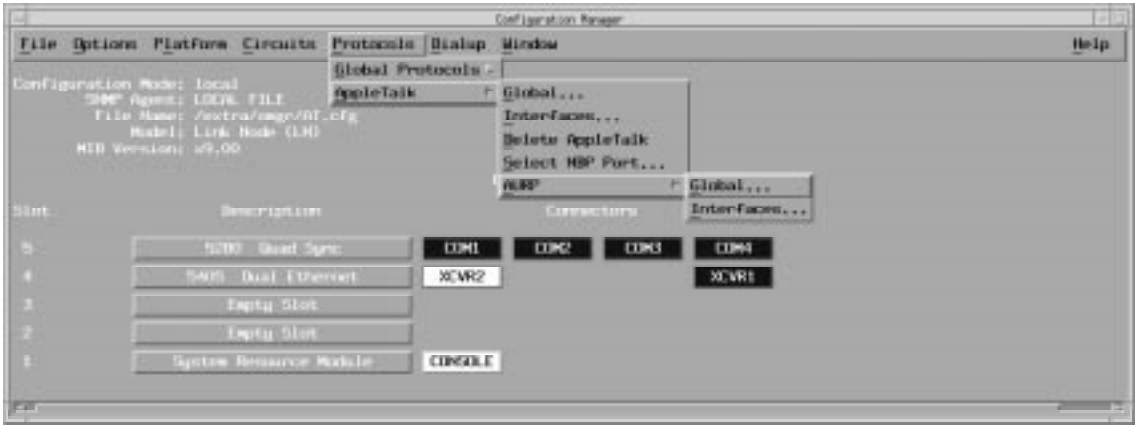


Figure 4-1. Configuration Manager Window

Editing the AppleTalk Global Parameter

To edit the AppleTalk global parameter, begin at the Configuration Manager window:

1. **Select Protocols > AppleTalk > Global.**

   The Edit AppleTalk Global Parameters window appears (Figure 4-2).

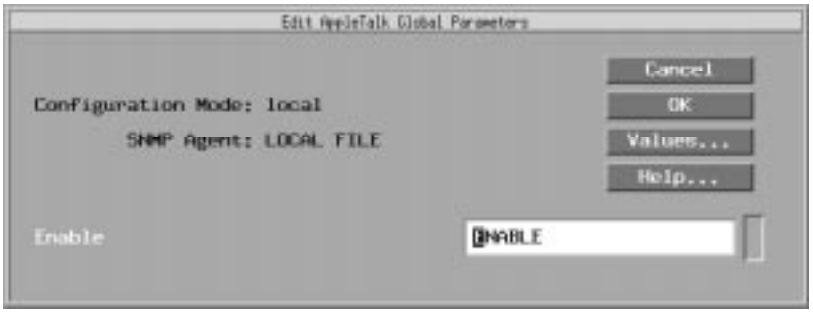


Figure 4-2. Edit AppleTalk Global Parameters Window

2. **Set the Enable parameter to Disable or Enable, using the following parameter description as a guide.**
3. **Click on OK to exit the window and save your changes when you are finished.**

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables AppleTalk on the entire Bay Networks router.
Instructions:	Set to Disable if you want to disable AppleTalk globally.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.1#2

Editing AppleTalk Interface Parameters

To edit an AppleTalk interface, begin at the Configuration Manager window:

1. **Select Protocols** > **AppleTalk** > **Interfaces.**

   The AT Interface Configuration window appears (Figure 4-3).

Figure 4-3. AT Interface Configuration Window

2. **Click on the interface you want to edit.**
3. **Edit those parameters you want to change, using the following parameter descriptions as a guide.**
4. **Click on Apply to implement your changes.**
5. **Click on Done to exit the window.**

Note: When you reconfigure an interface in dynamic configuration mode, AppleTalk restarts on that interface.

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables AppleTalk on this interface.
Instructions:	Set to Disable only if you want AppleTalk disabled on this interface (for example, if you are editing the interface's zone list).
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#2

Parameter:	**Network Start**
Default:	0
Options:	0 to 65279
Function:	Specifies the lower boundary (minimum) of the range of network numbers that are available for use by nodes on the network to which this interface connects. This parameter's setting determines whether this interface functions as a seed or nonseed router.
Instructions:	To configure this interface as a nonseed router, accept the default, 0. To configure this interface as a seed router, specify the Network Start parameter as follows: – If this is the only seed router on the network, determine the network range for this interface and enter the lower boundary network number here. – If there are already seed routers on the network, enter the *same* Network Start value that is configured on all other seed routers.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#13

Note: If you specify a Network Start other than the default 0, then (1) the router becomes a seed router automatically, and (2) you must also specify values for the Network End and Default Zone parameters.

Parameter:	**Network End**
Default:	0
Options:	0 to 65279
Function:	Specifies the upper boundary (maximum) of the range of network numbers that are available for nodes to use on the network to which this interface connects. This parameter is used with the Network Start parameter to help define a seed router. *If you have not specified a Network Start, this parameter is ignored.*
Instructions:	To configure this interface as a nonseed router, accept the default, 0. To configure this interface as a seed router, specify the Network End parameter as follows: – If this is the only seed router on the network, determine the network range for this interface and enter the upper boundary network number here. – If there are already seed routers on the network, enter the *same* Network End value that is configured on all other seed routers.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#14

Parameter: **Default Zone**

Default: None

Options: Any valid zone name

Function: Specifies the name of the Default Zone where all new nodes are assigned when they first start on this network.

This parameter is used with the Network Start and Network End parameters to help define a seed router. *If you have not specified a Network Start, this parameter is ignored.*

Instructions: To configure this interface as a nonseed router, leave this field blank.

To configure this interface as a seed router, specify the Default Zone as follows:

– If this is the only seed router on the network, enter any valid Default Zone name.

– If there are already seed routers on the network, enter the *same* Default Zone name configured on all other seed routers.

A valid zone name can consist of up to 32 characters and can include any character except an asterisk (*). For more information, refer to “Using Nonprintable Characters in AppleTalk Zone Names” in Chapter 3.

MIB Object ID: 1.3.6.1.4.1.18.3.5.4.3.1#15

Parameter: **Network ID**

Default: 0

Options: 0 to 65279

Function: Identifies the network number of the network to which this interface connects.

Instructions: We recommend accepting the default, 0, in which case the router dynamically acquires a Network ID and Node ID for the interface during startup (thus ensuring that the AppleTalk address for this interface is unique within the network).

If you change the default value, make certain that the number you specify is within the correct network range. The router then uses the Network ID that you specify.

MIB Object ID: 1.3.6.1.4.1.18.3.5.4.3.1#12

Note: If the AppleTalk address (Network ID.Node ID) matches that of any other node on the internet, the interface is automatically disabled.

Parameter:	**Node ID**
Default:	0
Options:	0 to 253
Function:	Identifies the node number assigned to this interface.
Instructions:	We recommend accepting the default, 0, in which case the router dynamically acquires a Network and Node ID for the interface during startup (thus ensuring that the AppleTalk address for this interface is unique within the network). If you change the default value, the router uses the Node ID you specify.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#11

Parameter:	**Interface Cost**
Default:	0
Options:	0 to 15
Function:	Specifies the additional number of hops (cost) added to routes that this interface learns via RTMP data packets.
Instructions:	If you want to limit the use of an interface, assign a high cost. If you do not want to limit the use of an interface, assign a low cost.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#79

Parameter:	**Checksum Enable**
Default:	Disable
Options:	Enable | Disable
Function:	Enables or disables the calculation of the DDP checksum for packets that the AppleTalk router originates on this interface. With checksumming enabled, the AppleTalk router calculates and includes a 16-bit checksum in the headers of DDP datagrams that it originates. With checksumming disabled, the router inserts a value of 0 into DDP datagrams that it originates. This parameter has no effect on incoming packets. If the router receives a packet containing a checksum, it verifies the checksum value.
Instructions:	We recommend accepting the default value, Disable. If this circuit contains excess noise, you can enable checksumming to ensure packet integrity.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#6

Parameter:	**TR End Station**
Default:	Disable
Options:	Enable | Disable
Function:	Specifies whether this interface is enabled for source routing endstation support.
Instructions:	Set to Enable if (1) this interface is a Token Ring circuit and (2) if source routing is enabled on the AppleTalk routers in this ring.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#7

Parameter:	**WAN MAC Address**
Default:	None
Options:	Any valid MAC address
Function:	Specifies the SMDS individual MAC address or the Frame Relay MAC address for this interface.
Instructions:	If this interface is of circuit type SMDS, or for specific Frame Relay networks, enter the MAC address . Note that the length of the address you specify must be correct for the circuit type. For example, for a Frame Relay circuit with 2-byte DLCIs, specify a 2-byte WAN broadcast address.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#10

Parameter:	**WAN Broadcast Address**
Default:	None
Options:	Any valid broadcast address
Function:	Specifies the Frame Relay or SMDS group broadcast address for this interface.
Instructions:	If this interface is of circuit type Frame Relay or SMDS, enter its broadcast address. Note that the length of the address you specify must be correct for the circuit type. For example, for a Frame Relay circuit with 2-byte DLCIs, specify a 2-byte WAN broadcast address.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#80

Parameter:	**Enable Split Horizon**
Default:	Enable
Options:	Enable | Disable
Function:	Specifies whether AppleTalk Split Horizon is enabled or disabled for Frame Relay interfaces.
Instructions:	Accept the default, Enable, unless this AppleTalk interface connects to a non-fully-meshed Frame Relay topology. If this interface does connect to a non-fully-meshed Frame Relay topology, reset to Disable so that the network does not split at the partial mesh. See the section "Configuring the AppleTalk Router in a Non-Fully Meshed Frame Relay Topology" in Chapter 2 for more information.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#81

Configuring AppleTalk Zone Lists

You can add or delete zones from an AppleTalk interface zone list.

When you edit an AppleTalk configuration in dynamic mode, you must wait at least 10 minutes between editing a zone list and reenabling the interface. This waiting period allows other routers on the network to update their zone information tables. See the following instructions.

Note: Because editing an AppleTalk zone list can affect your network's performance, refer to the section "Adding or Removing AppleTalk Zones" in Chapter 2 before proceeding.

Adding Zones to a Zone List

To add a zone to the AppleTalk router's zone list, begin at the Configuration Manager window (Figure 4-1):

1. **Select Protocols** > **AppleTalk** > **Interfaces.**

   The AT Interface Configuration window appears (Figure 4-3).

2. **Set the Enable parameter to Disable.**

3. **Click on Apply.**

   This disables the AppleTalk interface so that you can edit its zone list.

4. **Click on Zone List.**

   The AT Zone Configuration window appears (Figure 4-4). It lists the zones already configured for the router. You can add or delete zones from this window.

Note: Do not add the Default Zone to the interface's zone list.

Figure 4-4. AT Zone Configuration Window

5. **Click on Add.**
6. **Specify the zone name at the Zone Name parameter, using the following parameter description as a guide.**
7. **Click on OK.**

   The AT Zone Configuration window now lists the zone you added.

8. **Click on Done to exit the AT Zone Configuration window.**
9. **If you are configuring the AppleTalk router in dynamic mode, wait 10 minutes to allow all routers on the network to time out the network and zone information from their zone information tables.**
10. **Set the Enable parameter to Enable.**
11. **Click on Apply.**

This reenables the AppleTalk interface and implements your changes to the zone list.

12. **Click on Done to exit the AT Interface Configuration window.**

Parameter:	**Zone Name**
Default:	None
Options:	Any valid zone name. A valid zone name contains from 1 to 32 characters and can include any character except an asterisk (*). For more information, refer to “Using Nonprintable Characters in AppleTalk Zone Names” in Chapter 3.
Function:	Identifies the other zones (besides the Default Zone) specified for this network.
Instructions:	Enter a zone name.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.4.1#4

Deleting Zones from the Zone List

To delete a zone from the AppleTalk router’s zone list, begin at the Configuration Manager window shown in Figure 4-1:

1. **Select Protocols** > **AppleTalk** > **Interfaces.**

   The AT Interface Configuration window appears (Figure 4-3).

2. **Set the Enable parameter to Disable.**
3. **Click on Apply.**

   This disables the AppleTalk interface so that you can edit its zone list.

4. **Click on Zone List.**

   The AT Zone Configuration window appears (Figure 4-4).

5. **Click on the zone you want to delete.**
6. **Click on Delete.**

   The AT Zone Configuration window no longer lists the zone you deleted.

7. **Click on Done to exit the AT Zone Configuration window.**

8. **If you are configuring the AppleTalk router in dynamic mode, wait 10 minutes to allow all routers on the network to time out the network and zone information from their zone information tables.**
9. **Set the Enable parameter to Enable.**
10. **Click on Apply.**

    This reenables the AppleTalk interface and implements your changes to the zone list.
11. **Click on Done to exit the AT Interface Configuration window.**

Changing the AppleTalk Default Zone

When you initially configure an AppleTalk interface, you specify a Default Zone for the interface only if you want it to function as a seed router. If the interface functions as a nonseed router, then you leave the Default Zone parameter field blank.

To change the Default Zone for a seed router interface, begin at the Configuration Manager window (Figure 4-1):

1. **Select Protocols** > **AppleTalk** > **Interfaces.**

   The AT Interface Configuration window appears (Figure 4-3).
2. **Set the Enable parameter to Disable.**
3. **Click on Apply.**

   This disables the AppleTalk interface so that you can change the default zone.
4. **Click on an AppleTalk interface to select it.**
5. **Specify a new Default Zone at the Default Zone parameter.**
6. **Click on Apply.**
7. **Click on Done to exit the window.**
8. **If you are configuring the AppleTalk router in dynamic mode, wait 10 minutes to allow all routers on the network to time out the network and zone information from their zone information tables.**
9. **Set the Enable parameter to Enable.**
10. **Click on Apply.**

This reenables the AppleTalk interface and implements your changes to the zone list.

11. **Click on Done to exit the AT Interface Configuration window.**

Configuring AppleTalk Zone Filters

This section describes how to add or delete zone filters from an interface's zone filter list.

Note: Any changes you make to the zone filter list may not be immediately apparent to other AppleTalk routers on the network. For example, if you add a new filter, it may take time for other routers to learn about the new network information, or to time out the network information that is no longer being advertised because of the new filter.

Because the way you configure zone filters may affect your network performance, refer to the section "Using AppleTalk Zone Filters" in Chapter 2 before proceeding.

Adding Zones to the Zone Filter List

To add zones to an AppleTalk zone filter list, begin at the Configuration Manager window (Figure 4-1):

1. **Select Protocols** > **AppleTalk** > **Interfaces.**

   The AT Interface Configuration window appears (Figure 4-3).

2. **Click on Zone Filter.**

   The AppleTalk Zone Filter Configuration window appears (Figure 4-5). It lists the zone filters already configured for the router.

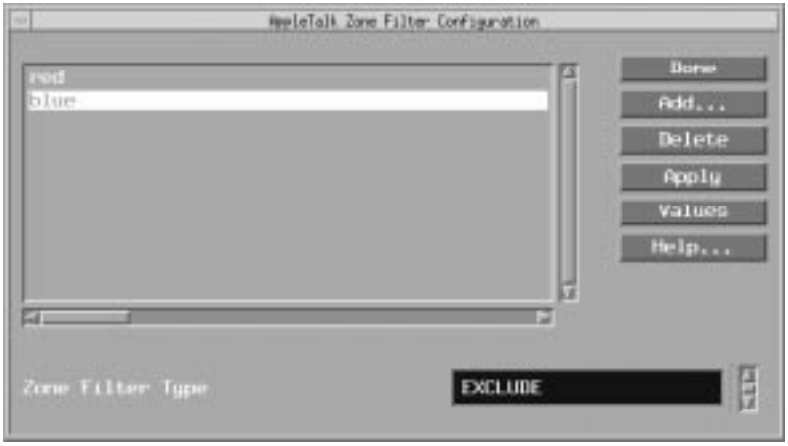


Figure 4-5. AppleTalk Zone Filter Configuration Window

3. **Click on Add.**

   The AppleTalk Zone Filter Configuration window displays the Zone Name field (Figure 4-6).

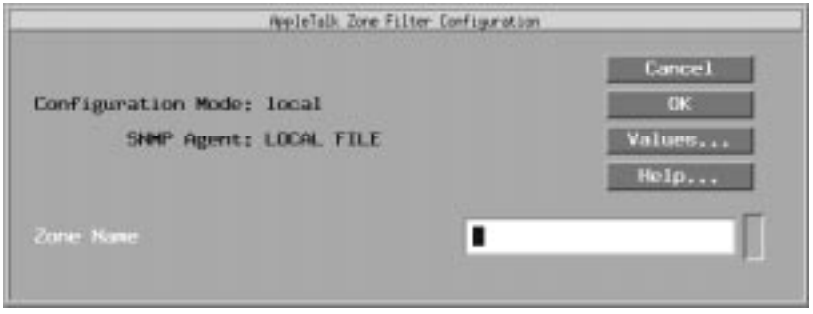


Figure 4-6. Adding a Zone Name

4. **In the Zone Name field, enter the name of the zone you want to filter.**

   For more information on the Zone Name parameter, refer to the section "Adding Zones to a Zone List" earlier in this chapter.

5. **Click on OK.**

The AppleTalk Zone Filter Configuration window now lists the zone filter you added. The zone filter type automatically defaults to Exclude. See the next section, "Editing the Zone Filter Type," for instructions on changing this parameter.

6. **Click on Done to save your changes and exit the window.**

Editing the Zone Filter Type

A zone filter can be one of two types, Exclude or Include. You can configure a zone filter list to partially deny or allow zones, using the 5.X Exclude and 5.X Include options.

Note: By default, the zone filter type is set to Exclude.

When you configure an exclude zone filter list, the interface advertises that it can reach all zones *except* those specified on the list. This type of filter is useful if you want to filter out only a few of the zones that the router knows about.

When you configure an include zone filter list, the interface advertises that it can reach only those zones specified on the list. This type of filter list is useful if you want to filter out most of the zones that the router knows about.

When you configure a zone filter list using the 5.X Include or 5.X Exclude options, the interface advertises that it can reach only those zones you allow on the list. The interface will always advertise the networks associated with the zones in the zone filter list.

For more information about zone filters, see Chapter 2.

To change the zone filter type, begin at the Configuration Manager window (Figure 4-1):

1. **Select Protocols** > **AppleTalk** > **Interfaces.**

   The AT Interface Configuration window appears (Figure 4-3).

2. **Click on Zone Filter.**

   The AppleTalk Zone Filter Configuration window appears (Figure 4-5). It lists the zone filters already configured for the router.

3. **Set the Zone Filter Type parameter to Exclude, Include, 5.X Include, or 5.X Exclude, as appropriate.**

   The Zone Filter Type parameter is described following these instructions.

4. **Click on Apply to implement your changes.**

5. **Click on Done to exit the AppleTalk Zone Filter Configuration window.**

Parameter:	**Zone Filter Type**
Default:	Exclude
Options:	Include | Exclude | 5.X Include | 5.X Exclude
Function:	Specifies the filter action. If you set this parameter to Exclude, then the router excludes the zones on the zone filter list from its zone information table. If you set this parameter to Include, then the router includes only the zones on the zone filter lists in its zone information table. If you set this parameter to 5.X Include, then the router includes only those specified zones in its zone information table. The networks associated with these zones will always be advertised. If you set this parameter to 5.X Exclude, then the router excludes only those specified zones from its zone information table. The networks associated with these zones will always be advertised.
Instructions:	Specify Include, Exclude, 5.X Include, or 5.X Exclude, depending on the filter action you want.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.3.1#82

Deleting Zones from the Zone Filter List

To delete AppleTalk zones from an AppleTalk interface's zone filter list, begin at the Configuration Manager window shown in Figure 4-1:

1. **Select Protocols** > **AppleTalk** > **Interfaces.**

   The AppleTalk Interface Configuration window appears (Figure 4-3).

2. **Click on Zone Filter.**

   The AppleTalk Zone Filter Configuration window appears (Figure 4-5). It lists the zone filters already configured for the router.

3. **Click on the zone you want to delete.**

4. **Click on Delete.**

   The AppleTalk Zone Filter Configuration window no longer lists the zone.

5. **Click on Done to exit the AppleTalk Zone Filter Configuration window.**

6. **Click on Done to exit the AppleTalk Interface Configuration window.**

Selecting the Name Binding Protocol Interface

When you enable AppleTalk routing services, NBP uses the *first* AppleTalk interface you configure to advertise the router's name on the network.

To specify a different AppleTalk NBP interface, begin at the Configuration Manager window and proceed as follows:

1. **Select Protocols** > **AppleTalk** > **Select NBP Port.**

   The AT Interfaces window appears (Figure 4-7).

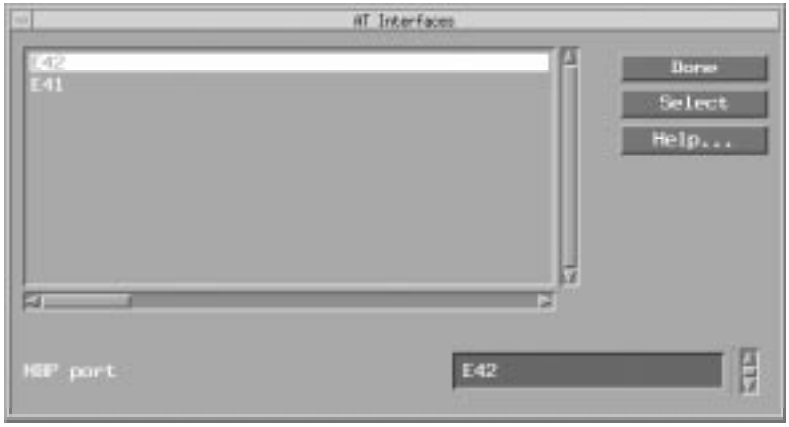


Figure 4-7. AT Interfaces Window

2. **Click on the AppleTalk interface you want NBP to use to advertise the router's name on the network.**
3. **Click on Select.**

   The interface you selected appears in the NBP port field. For more information about this field, see the parameter description that follows.
4. **Click on Done to save your changes and exit the window.**

Parameter:	**NBP Port**
Default:	The first AppleTalk interface you configured
Options:	Other configured AppleTalk interfaces
Function:	Indicates the AppleTalk interface you want NBP to use to advertise the router's name on the network.
Instructions:	Accept the default or select a different AppleTalk interface.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.1#6

Globally Deleting AppleTalk

To delete the AppleTalk routing protocol from all Bay Networks router circuits on which it is currently enabled, begin from the Configuration Manager window (Figure 4-1):

1. **Select Protocols** > **AppleTalk** > **Delete AppleTalk.**

   A window opens and prompts

   ```
   Do you REALLY want to delete AppleTalk?
   ```

2. **Click on OK.**

   The Configuration Manager window appears. AppleTalk is no longer configured on the Bay Networks router.

Editing AURP Global Parameters

To edit AURP global parameters, begin at the Configuration Manager window:

1. **Select Protocols** > **AppleTalk** > **AURP** > **Global.**

   The Edit Apple AURP Global Parameters window appears (Figure 4-8).

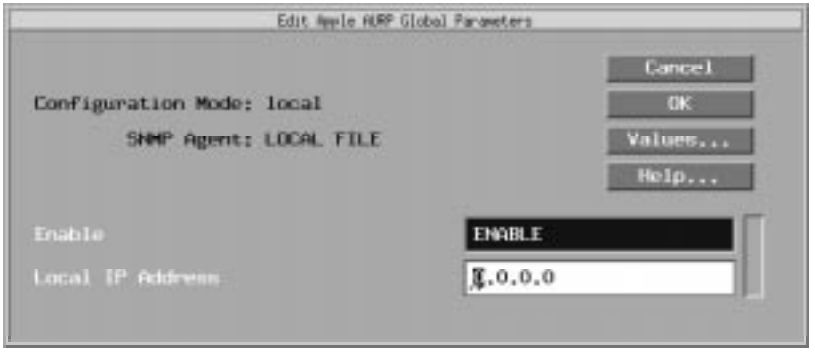


Figure 4-8. Edit Apple AURP Global Parameters Window

2. **Set the Enable parameter to Disable or Enable, using the following parameter descriptions as a guide.**
3. **Enter the appropriate IP address (using dotted-decimal notation) in the Local IP Address field.**

4. **Click on OK to exit the window and save your changes when you are finished.**

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables AURP on the router.
Instructions:	Set to Disable if you want to globally disable AURP.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.8#2

Parameter:	**Local IP Address**
Default:	None
Options:	Any valid 32-bit IP address using dotted-decimal notation; for example, 205.1.8.2
Function:	Identifies an IP interface on the router. This is the IP interface used for AURP.
Instructions:	Enter the IP address of the interface on this router that AURP should use.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.8#5

Editing AURP Interface Parameters

You use the AURP *interface* parameters to configure an AURP *connection*. To edit an AURP connection, begin at the Configuration Manager window:

1. **Select Protocols** > **AppleTalk** > **AURP** > **Interfaces.**

   The AT AURP Interface Configuration window appears (Figure 4-9).

Figure 4-9. AT AURP Interface Configuration Window

2. **Click on the interface you want to edit.**
3. **Edit those parameters you want to change, using the following parameter descriptions as a guide.**
4. **Click on Apply to implement your changes.**
5. **Click on Done to exit the window.**

Parameter:	**Enable**
Default:	Enable
Options:	Enable | Disable
Function:	Enables or disables AURP on this IP tunnel.
Instructions:	Set to Enable or Disable to configure AURP for this connection.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#2

Parameter:	**Timeout Command**
Default:	3 seconds
Options:	1 to 1000 s
Function:	Specifies the number of seconds to wait for an acknowledgment before retrying an AURP command.
Instructions:	Specify a value in seconds.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#6

Parameter:	**Command Retries**
Default:	3
Options:	1 to 100
Function:	Specifies the number of attempts at sending an AURP command.
Instructions:	Specify a value for the number of retries.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#7

Parameter:	**Update Rate**
Default:	30 s
Options:	10 to 604800 s (1 week)
Function:	Specifies the rate (in seconds) at which routing table updates are sent out on this connection.
Instructions:	Specify a value that is a multiple of 10. Refer to Table 4-1 for a list of popular values in seconds.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#8

Table 4-1. Time Equivalents in Seconds

Length of Time	Seconds
5 min	300
30 min	1,800
1 hr	3,600
8 hr	28,800
1 day	86,400
1 wk	604,800
1 mo	2,419,200*

*. Not valid for Update Rate. Use only for Last Heard From Timeout parameter.

Parameter: **Last Heard From Timeout**

Default: 90

Options: 30 to 31536000 s (1 yr)

Function: Specifies the number of seconds to wait for an RI-Rsp, RI-Upd, or ZI-Rsp before sending a Tickle request.

Instructions: Specify a value that is a multiple of 10. Refer to Table 4-1 for a list of popular values in seconds.

MIB Object ID: 1.3.6.1.4.1.18.3.5.4.9.1#9

Parameter:	**Hop Count Reduction**
Default:	Disable
Options:	Enable | Disable
Function:	Enables or disables hop count reduction.
Instructions:	Set to Enable to enable hop count reduction. Set to Disable to disable hop count reduction. Do not use hop count reduction in a topology that has loops (AURP or RTMP).
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#10

Parameter:	**Interface Cost**
Default:	0 hops
Options:	0 to 15 hops
Function:	Specifies the additional number of hops (cost) added to routes that this interface learns via RTMP data packets.
Instructions:	If you want to limit the use of an interface, assign a high cost. If you do not want to limit the use of an interface, assign a low cost. See “Specifying Interface Costs” in Chapter 2 for more information.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#11

Parameter:	**Zone Filter Default Zone**
Default:	None
Options:	Any valid zone name
Function:	Specifies the name of the Default Zone used for the 5.X Include or 5.X Exclude options.
Instructions:	Enter an appropriate zone name. A valid zone name contains from 1 to 32 characters and can include any character except for the asterisk (*). For more information, refer to “Using Nonprintable Characters in AppleTalk Zone Names” in Chapter 3.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#80

Editing the AURP Zone Filter List

To edit the AURP zone filter list, begin at the AT AURP Interface Configuration window (Figure 4-9) and click on Zone Filter. The AppleTalk Zone Filter Configuration window appears (Figure 4-5). AURP zone filter lists work the same way as regular AppleTalk zone filter lists. For information on how to configure zone filter lists, see the section “Configuring AppleTalk Zone Filters” in this chapter. Refer to the following AURP-specific zone parameters.

Parameter:	**Zone Filter Type**
Default:	Exclude
Options:	Exclude | Include | 5.X Exclude | 5.X Include
Function:	Controls zone filtering on this AURP connection.
Instructions:	If you set this parameter to Exclude, then the router excludes the zones on the zone filter list from its zone information table. If you set this parameter to Include, then the router includes only the zones on the zone filter lists in its zone information table. If you set this parameter to 5.X Include, then the router includes only those specified zones in its zone information table. The networks associated with these zones will always be advertised. If you set this parameter to 5.X Exclude, then the router excludes only those specified zones from its zone information table. The networks associated with these zones will always be advertised.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.9.1#5

Note: If you delete all the zones listed in the Zone Filter window and then leave the Zone Filter Type value set to Include, AURP no longer advertises any zones. You must set the value back to the default, Exclude.

Parameter:	**Zone Name**
Default:	None
Options:	Any valid zone name
Function:	Identifies the zone name that should be excluded or included (depending on what you specified for the Zone Filter Type parameter).
Instructions:	Enter an appropriate zone name. A valid zone name contains from 1 to 32 characters and can include any character except for the asterisk (*). For more information, refer to “Using Nonprintable Characters in AppleTalk Zone Names” in Chapter 3.
MIB Object ID:	1.3.6.1.4.1.18.3.5.4.7.1#6

Appendix A
AppleTalk Default Settings

Tables A-1 to A-5 show the default settings for the AppleTalk and AURP parameters in Site Manager. Use the Configuration Manager (and refer to Chapter 4) to edit any of the default settings shown here.

Table A-1. AppleTalk Global Parameters

Parameter	Default
Enable	Enable

Table A-2. AppleTalk Interface Parameters

Parameter	Default
Enable	Enable
Network Start	0
Network End	0
Default Zone	None
Network ID	0
Node ID	0
Interface Cost	0 hops
Checksum Enable	Disable
TR End Station	Disable
WAN MAC Address	None

Table A-2. AppleTalk Interface Parameters *(continued)*

Parameter	Default
WAN Broadcast Address	None
Enable Split Horizon	Enable

Table A-3. AURP Global Parameters

Parameter	Default
Enable	Enable
Local IP Address	None

Table A-4. AURP Interface Parameters

Parameter	Default
Enable	Enable
Timeout Command	3 s
Command Retries	3
Update Rate	30 s
Last Heard from Timeout	90 s
Hop Count Reduction	Disable
Interface Cost	0 hops
Zone Filter Default Zone	None

Table A-5. AURP Zone Filter List Parameters

Parameter	Default
Zone Filter Type	Exclude
Zone Name	None

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